

Deep-Energy Building Retrofit

Fanshawe College – London Campus
Kestrel Court Research Project
Tom Davis, P.Eng., PE, LEED AP



FANSHAWE



Clean Air Partnership

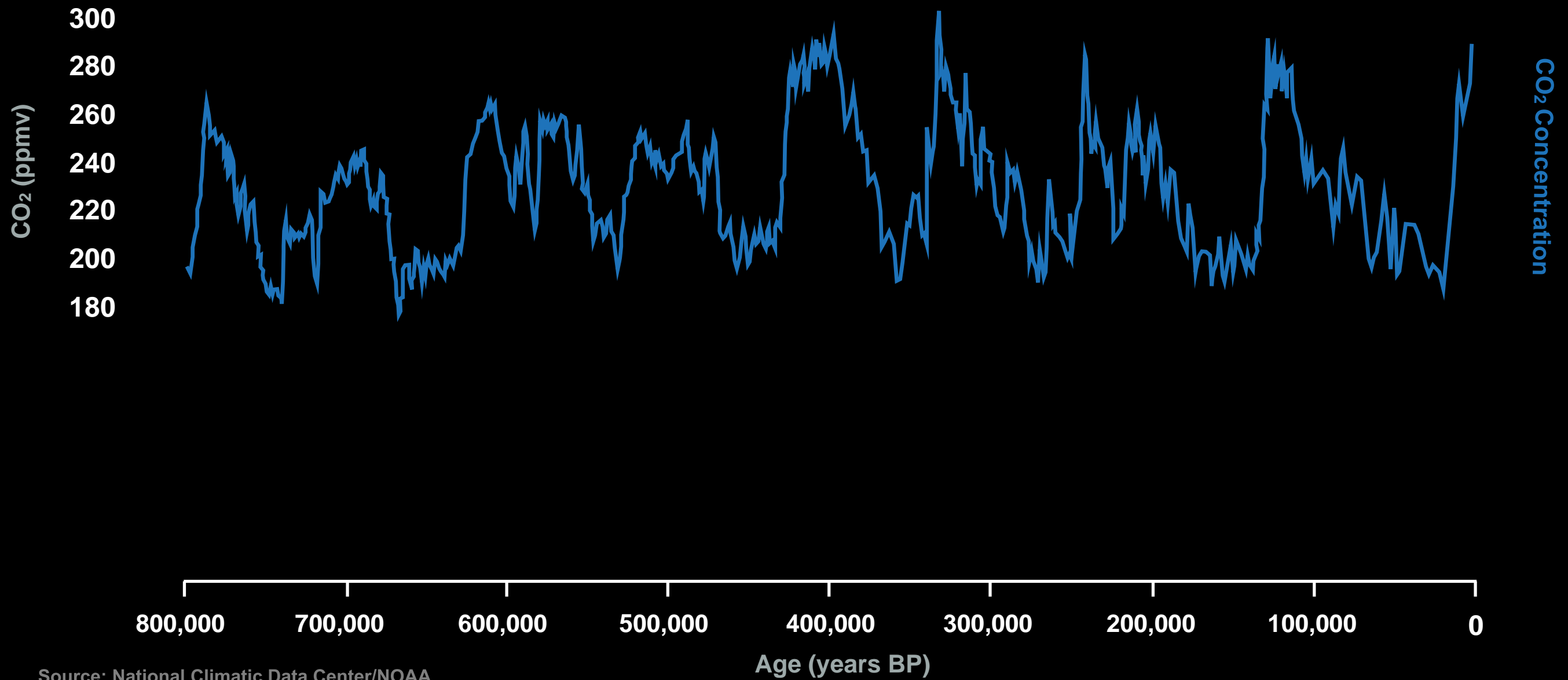
A Little Perspective ...

per·spec·tive

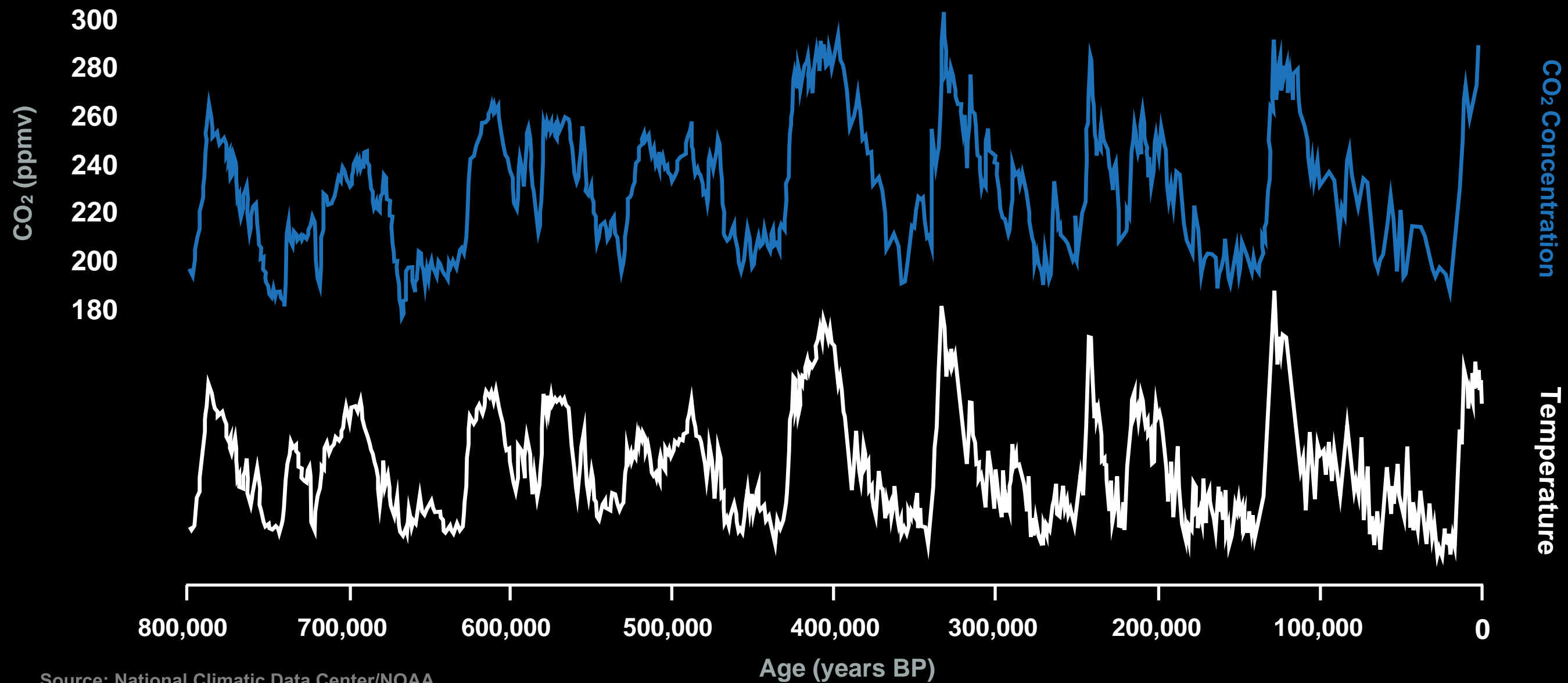
/pər'spektiv/

*a particular attitude toward or
way of regarding something;
a point of view....*

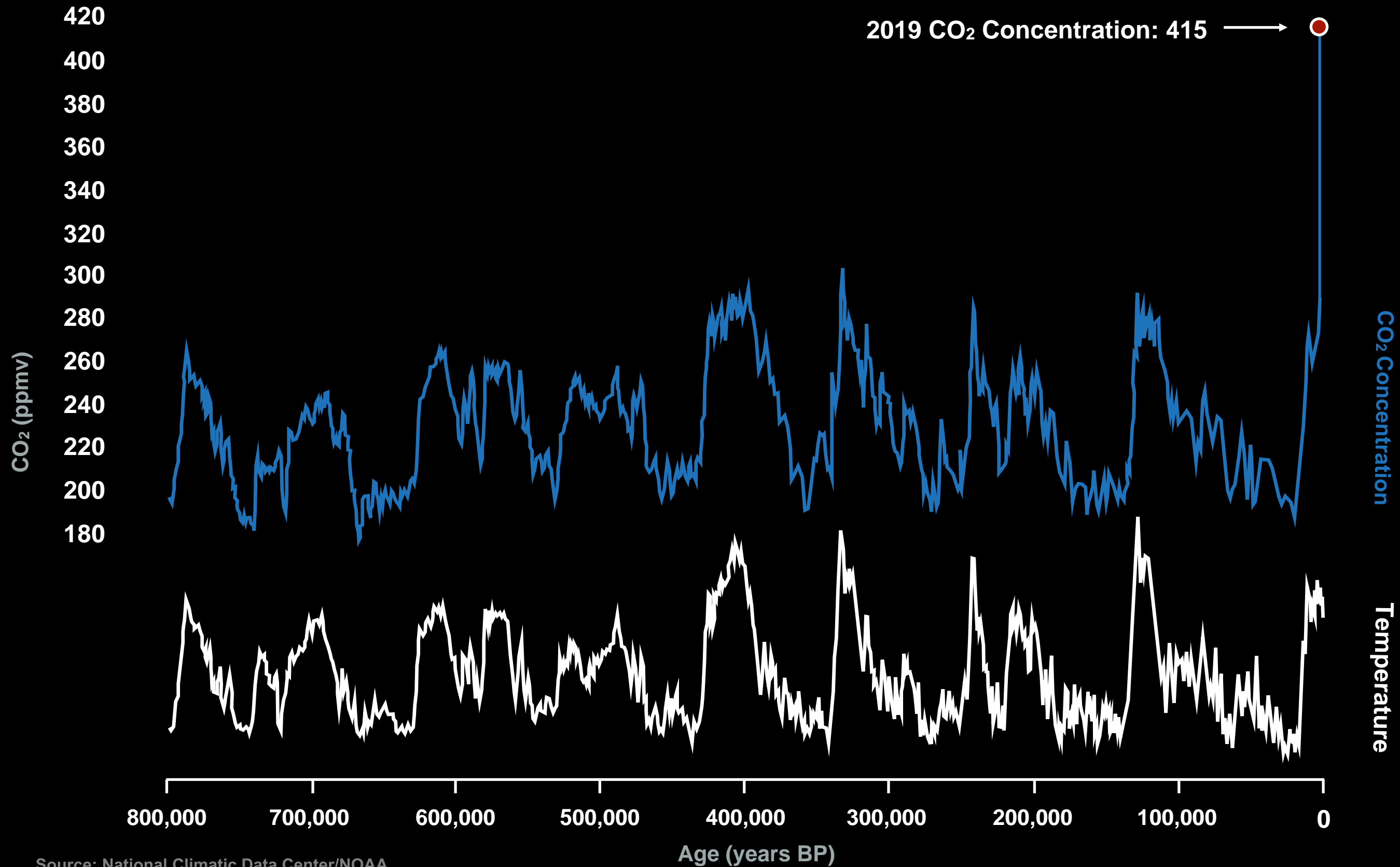




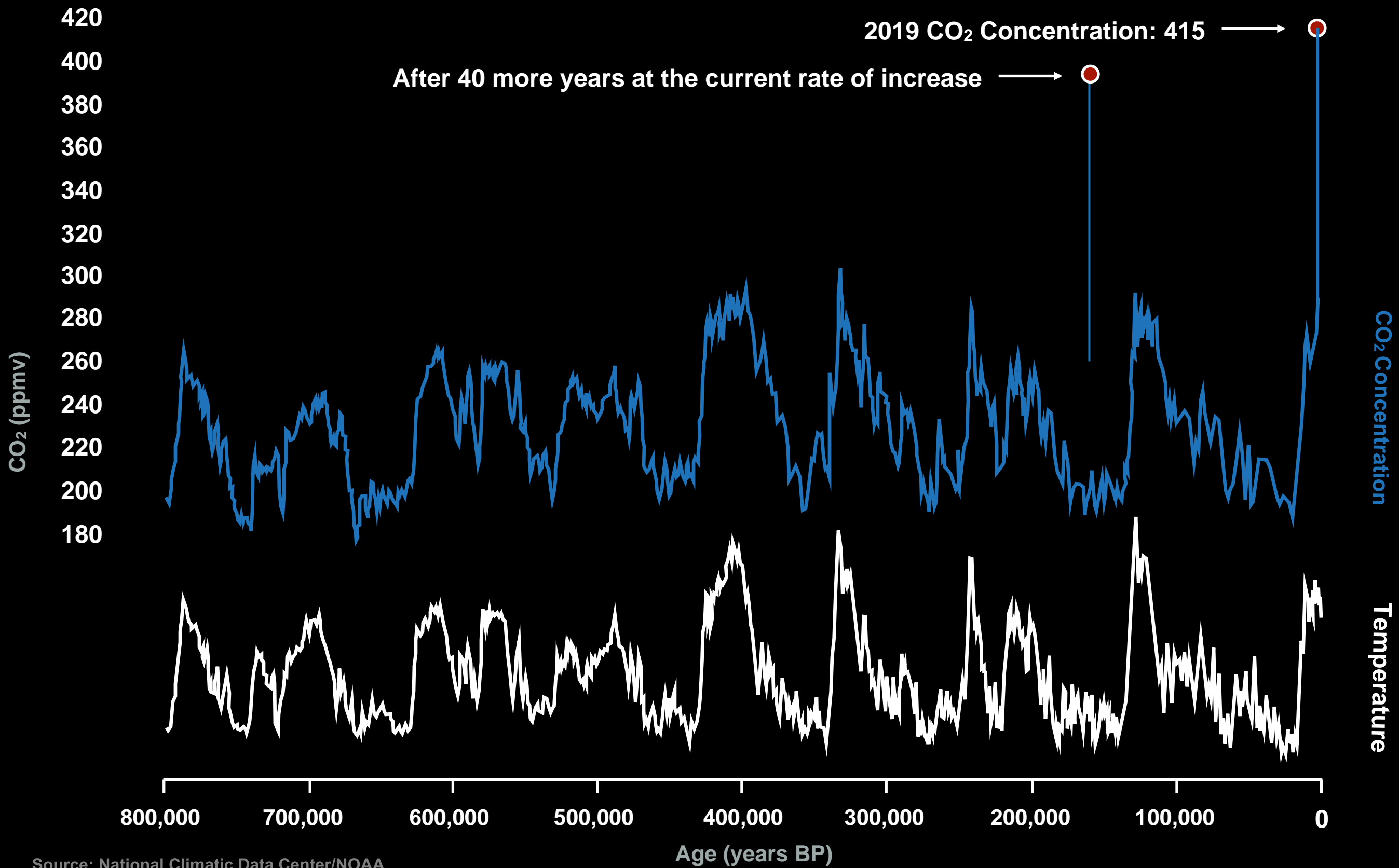
Source: National Climatic Data Center/NOAA



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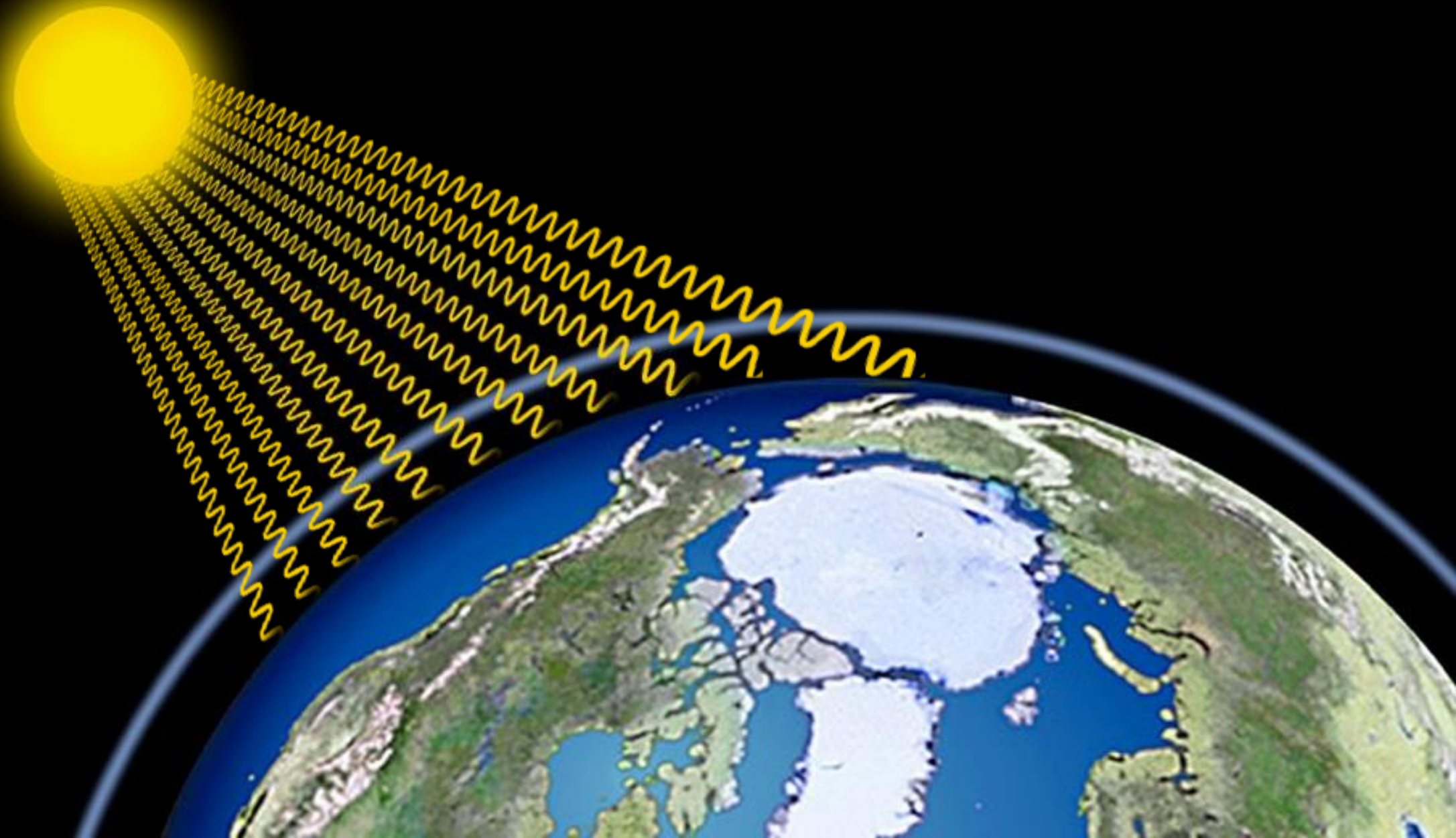


Source: National Climatic Data Center/NOAA



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Enough solar energy reaches Earth **every hour**
to fill all the world's energy needs **for a full year**



Global Cumulative Storage Capacity

Historical

Gigawatts

3.0
2.5
2.0
1.5
1.0
0.5
0.0

2011

2012

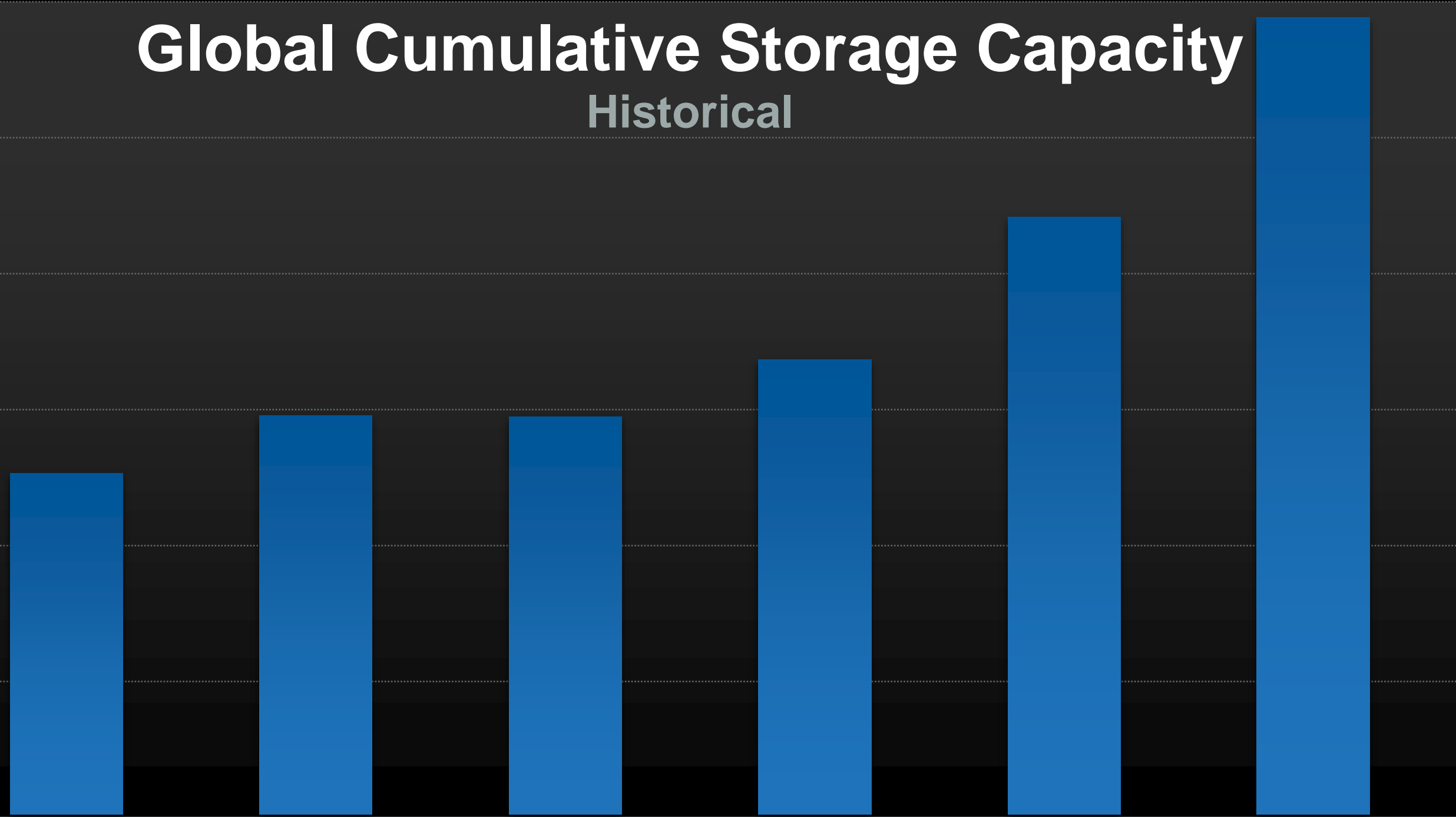
2013

2014

2015

2016

Data:
Bloomberg
New Energy
Finance



Global Cumulative Storage Capacity

Projected to 2040

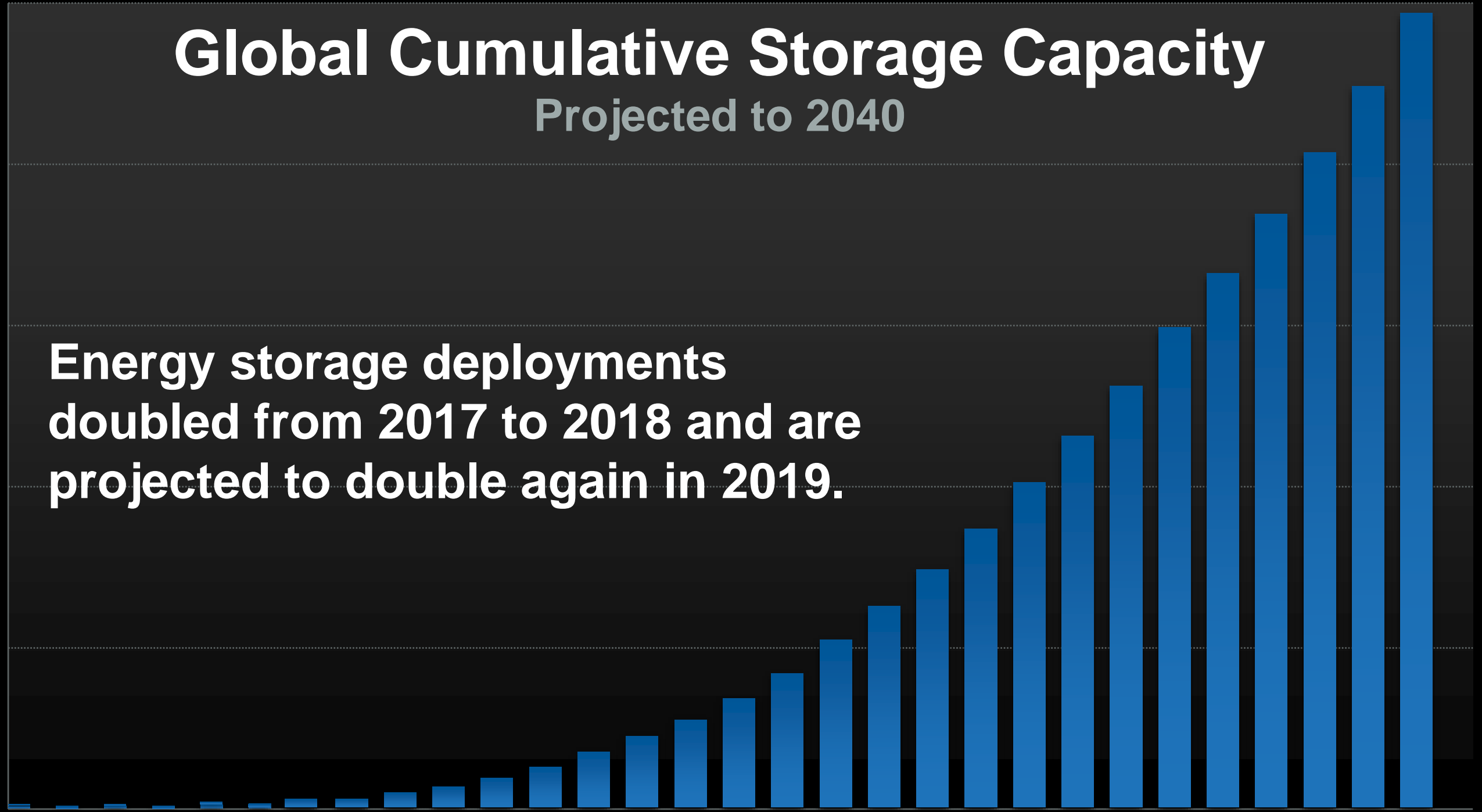
Gigawatts

Energy storage deployments doubled from 2017 to 2018 and are projected to double again in 2019.

1,000
800
600
400
200
0

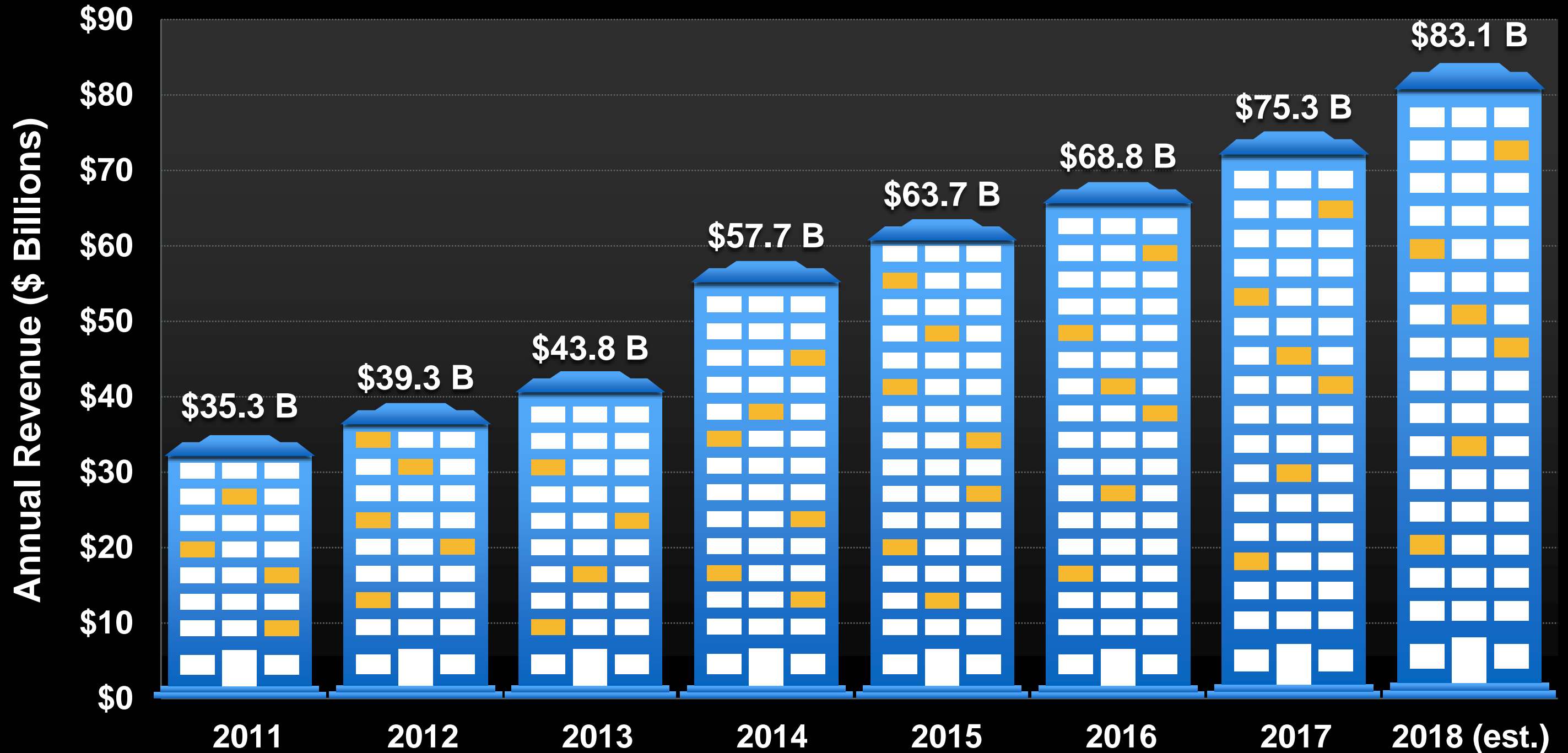
2011 2013 2015 2017 2019 2021 2023 2025 2027 2029 2031 2033 2035 2037 2039

Data:
Bloomberg
New Energy
Finance





U.S. Building Efficiency Market



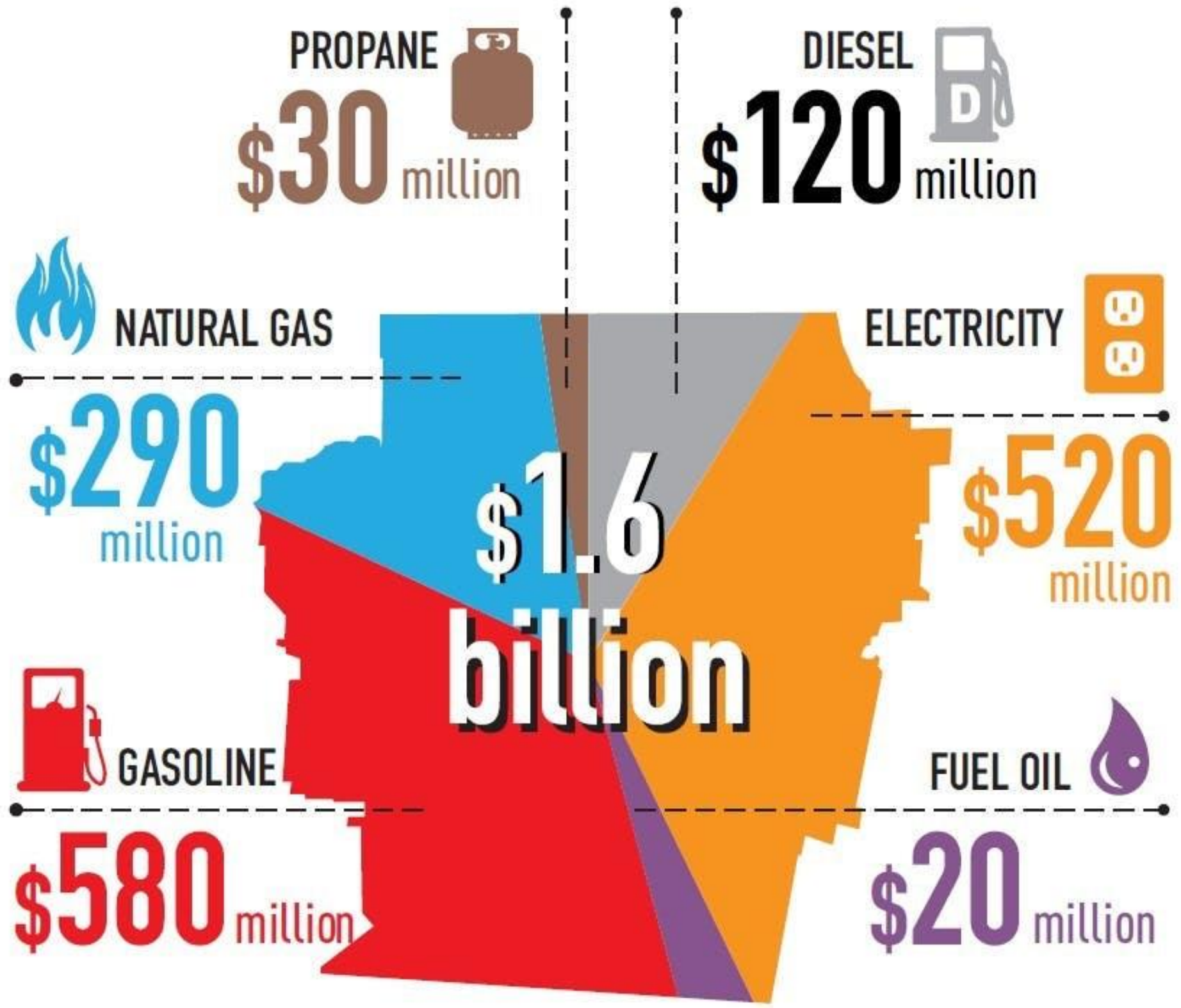


Cumulative global investment in commercial building energy efficiency retrofits will total \$959 billion from 2014 through 2023.

“I’d put my money on the sun and solar energy. What a source of power!

I hope we don’t have to wait until oil and coal run out before we tackle that.”

Thomas Edison





***Good jobs and
a livable future!***

Greta Thunberg is right: It's time to haul ass on
climate change - Vox

Priority skills for the success of Fanshawe graduates

1. Novel and Adaptive Thinking

Find innovative, creative and unconventional relationships between things or concepts

2. Resilience

Succeed through adversity

3. Social Intelligence

Build and nurture mutually beneficial relationships

4. Self-Directed Learning

Identify and achieve personal learning goals

5. Global Citizenship

Create an awareness of the wider world and our place in it

6. Complex Problem Solving

Find solutions to real-world problems

7. Implementation Skills

Manage projects to achieve key milestones and outcomes



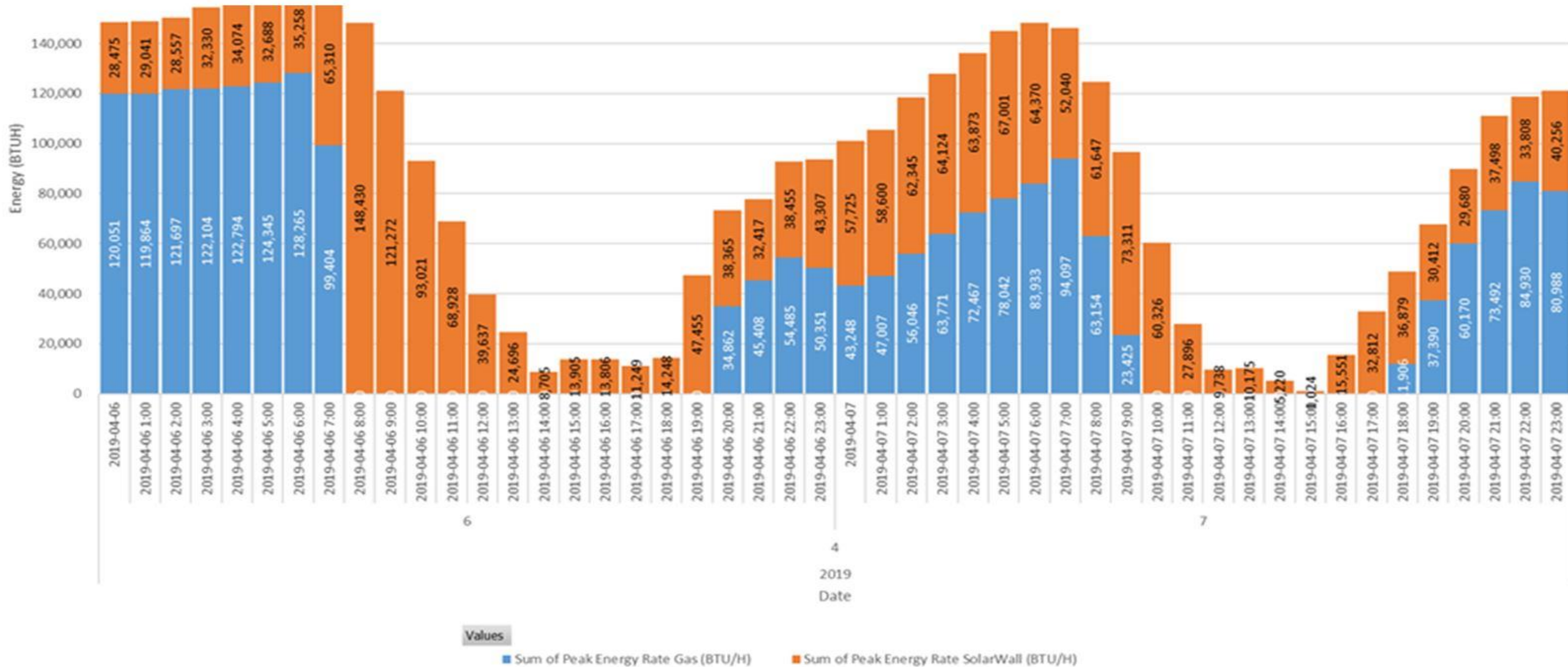
Genie Z-80/60







Solar power works even on cloudy and cold days. Yes, really!



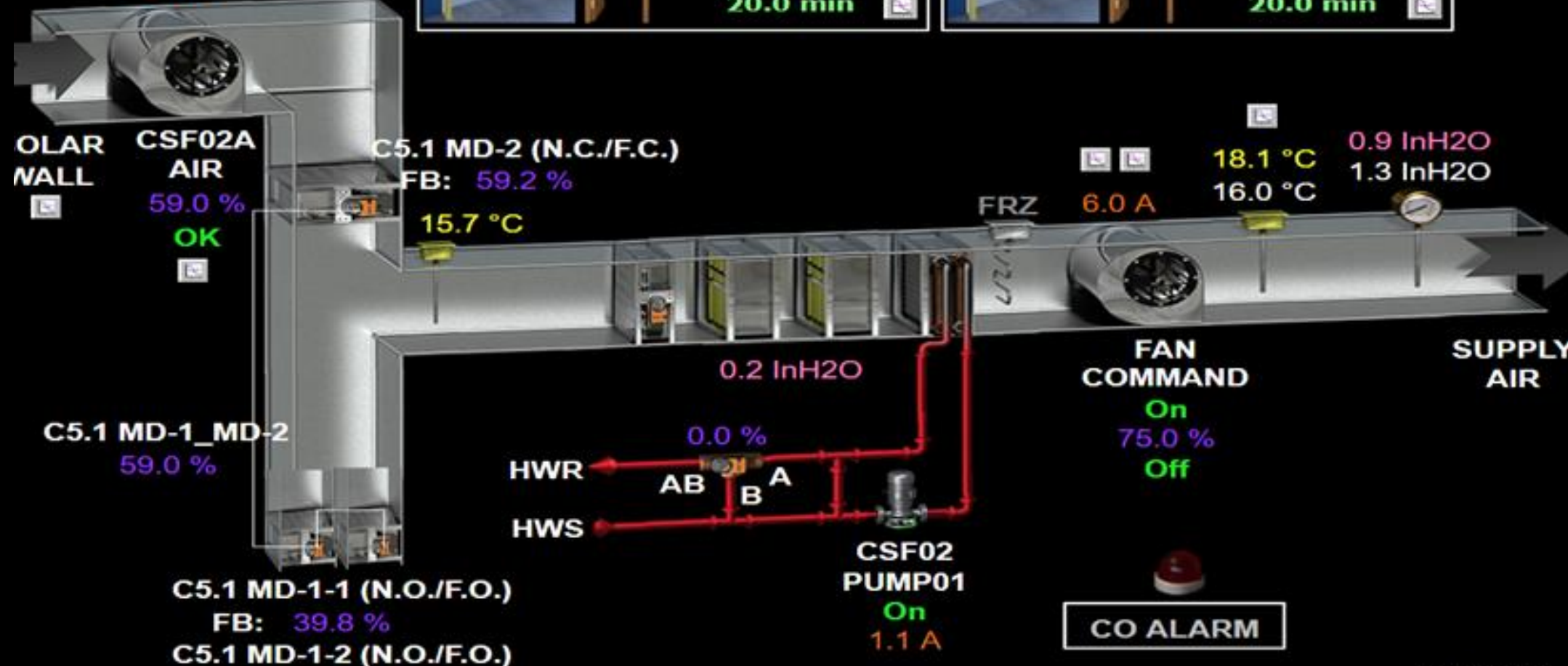
PLAR WALL C5.1
R TEMP 19.6 °C
CO: 0.1 ppm
NO2: 0.0 ppm
2.0 A

C1004 N

STROBE/SIREN
OK
TIME DELAY
20.0 min

C1004 SW

STROBE/SIREN
OK
TIME DELAY
20.0 min



Previous
←

C1004 WW CO C1004 WN CO C1004 WS CO C1004 W

0.0 ppm 0.0 ppm 0.2 ppm 21.5 °C 20.0 °C





germans
(5

HELPING BUILD A GREENER FUTURE...

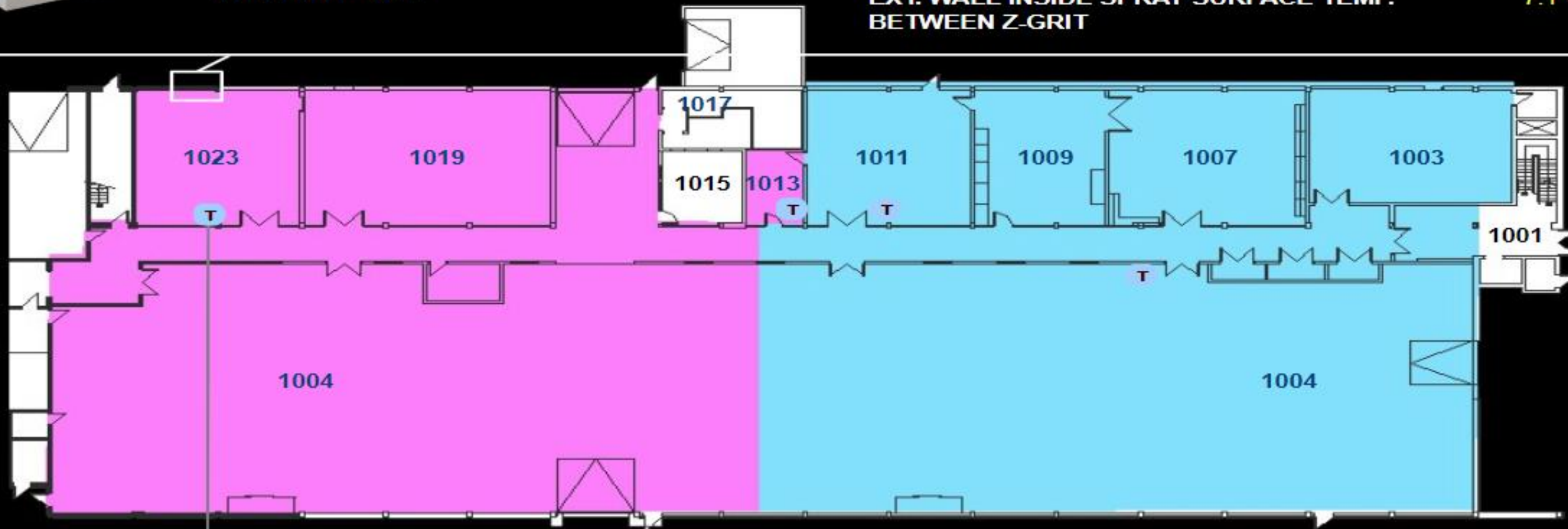


WINDOW / WALL SENSOR



INT. FRAME TOP SURFACE TEMP. 19.1 °C
 INT. GLASS CENTRE SURFACE TEMP. 20.4 °C
 INT. WALL SURFACE TEMP. Z-GRIT 20.8 °C
 INT. WALL SURFACE TEMP. BETWEEN Z-GRIT 21.1 °C

EXT. FRAME TOP SURFACE TEMP. 4.7 °C
 EXT. GLASS CENTRE SURFACE TEMP. -0.4 °C
 EXT. WALL SURFACE TEMP. Z-GRIT 0.5 °C
 EXT. WALL SURFACE TEMP. BETWEEN Z-GRIT 1.1 °C
 EXT. WALL INSIDE SPRAY SURFACE TEMP. Z-GRIT 4.8 °C
 EXT. WALL INSIDE SPRAY SURFACE TEMP. BETWEEN Z-GRIT 7.1 °C



22.1 °C
21.5 °C



Sungrow
Inverters

West Section

West Section



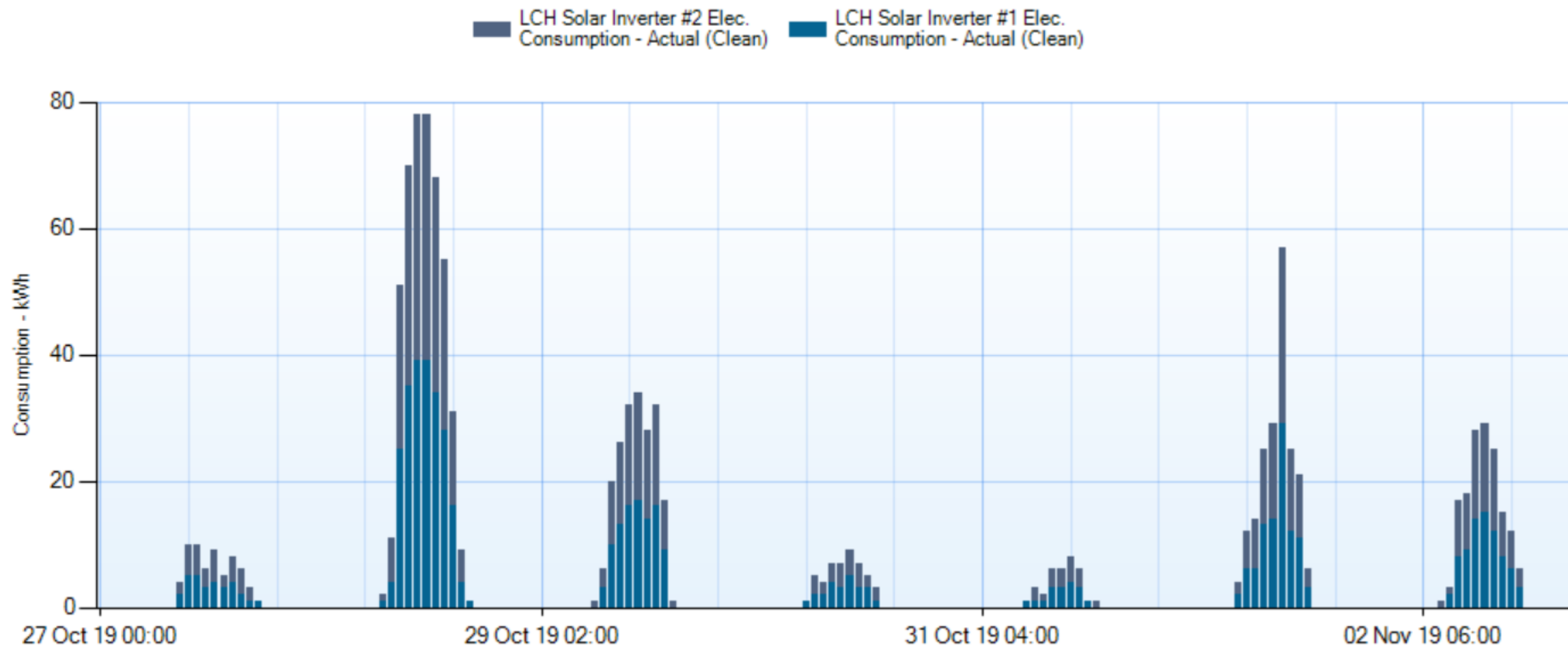
Shutdown

Implementation

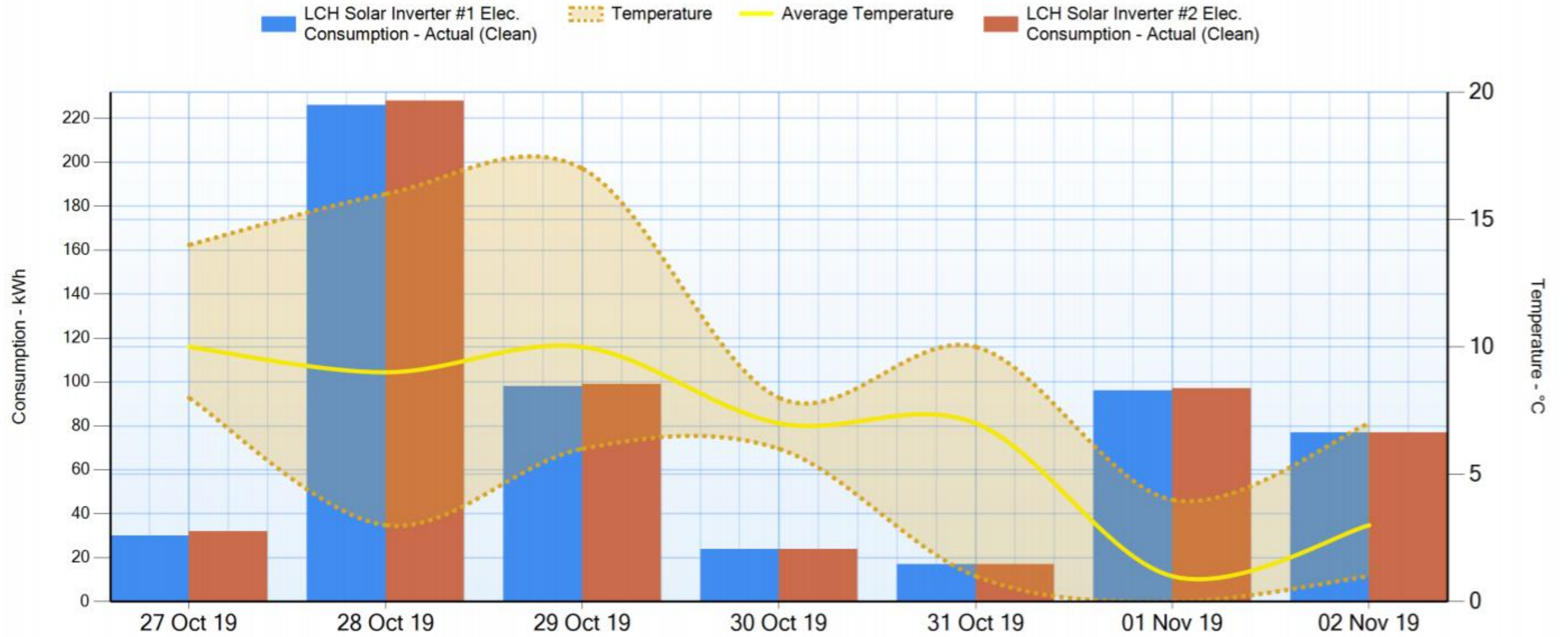
Solar power works even on cloudy and cold days. Yes, really!

Meter profile

Last week - Ending Saturday, November 02, 2019



Last week - Ending Saturday, November 02, 2019





Solar PV - Research and Education Centre



Research and Education Centre (REC)

15 x 385W Bifacial PV Panels

24 x 305W panels

13 kWp Total Connected Load



Solar PV Off-Grid Connection to Heat Domestic Hot Water

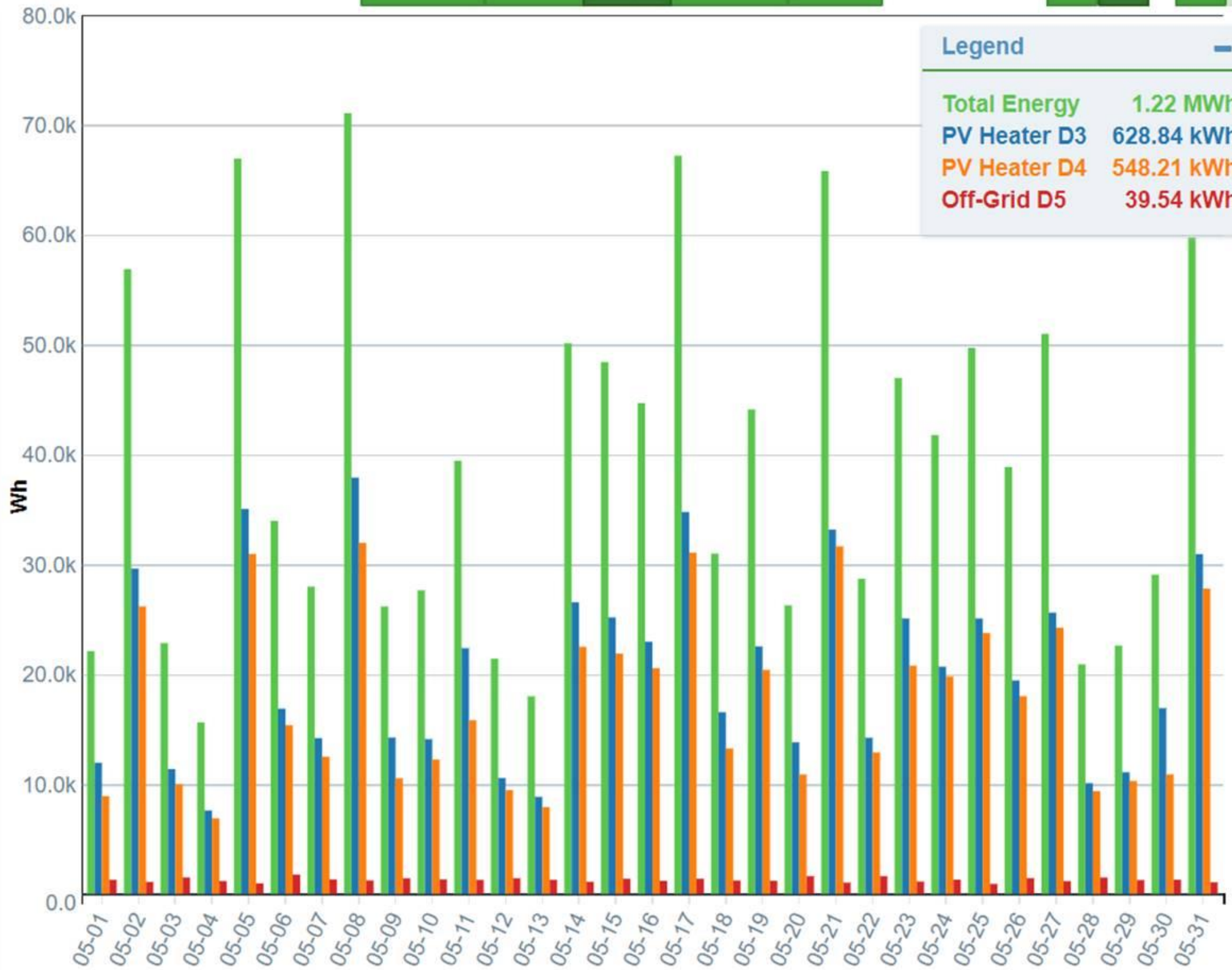
Offset gas fired heaters

Utilize water tank as energy storage

Research and Education

< May 2019 >

Minutes Hours Days Months Years



Legend

Total Energy	1.22 MWh
PV Heater D3	628.84 kWh
PV Heater D4	548.21 kWh
Off-Grid D5	39.54 kWh



What's next?

- Today there is only one labelled Net Zero ready home renovation in all of Canada.
- This is insufficient to start Canada down the path to renovating the existing 14.5 million homes on the scale that is required.

Why?

- a solid building science background
- the opportunity to experiment with new ideas
- test bed to prove out good ideas and weed out others
- support for manufacturers in bringing sound, new products to market
- accelerated market penetration
- reduced risk for contractors and consumers
- Save The Planet?

Existing Conditions

Existing Conditions



Foundation Wall

Cracking



Exposed Rebar



Cracking at Windows



Above Grade Walls and Roof

Vinyl Deteriorating



Weep Vents



Roof Space





Spot 17.4 °C

FLIR

57.5



-12.2

2020-01-20
11:13 AM

Spot -9.5 °C

FLIR

-5.5



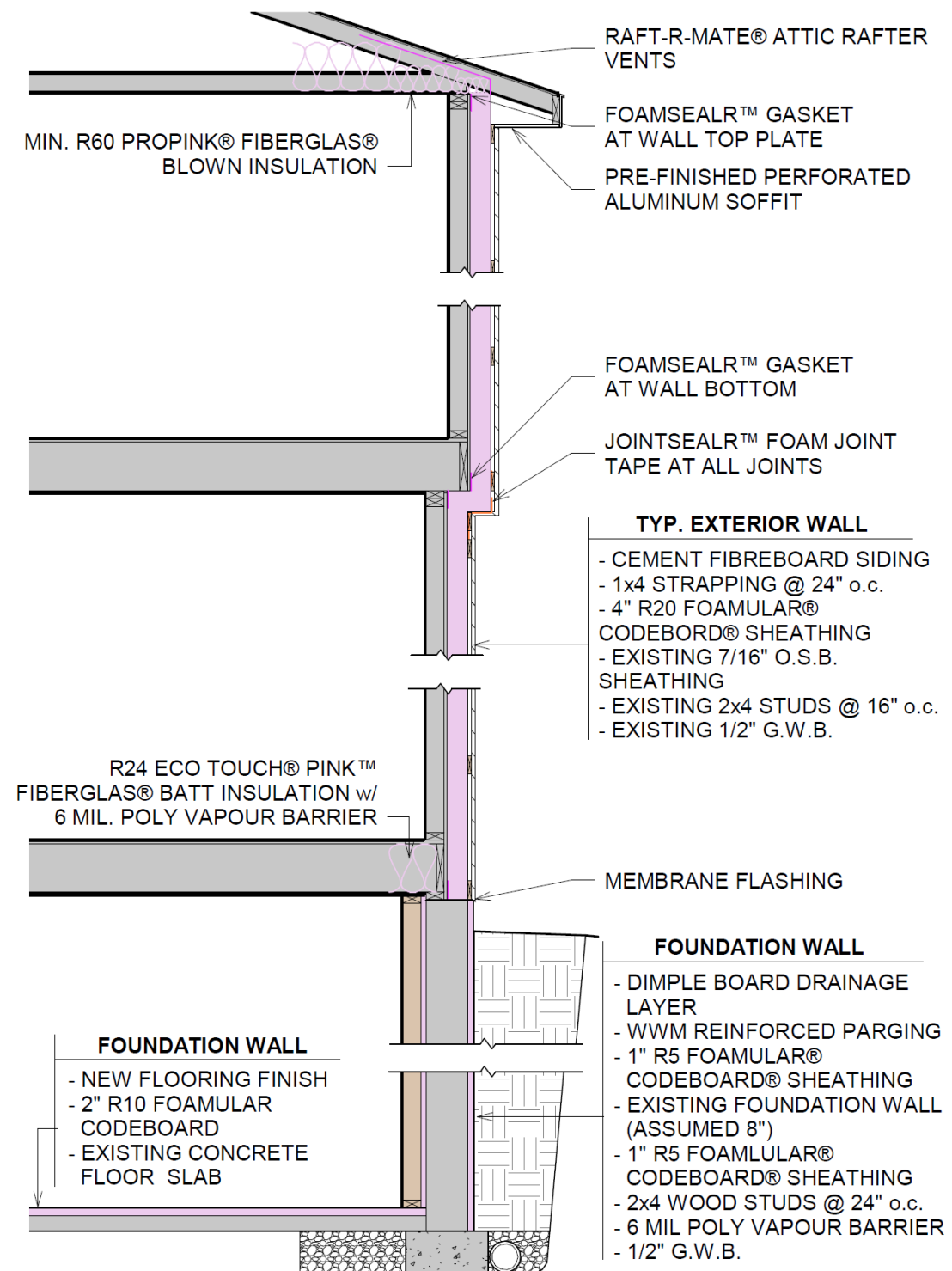
-60.0

2020-01-20
11:24 AM

Overviews

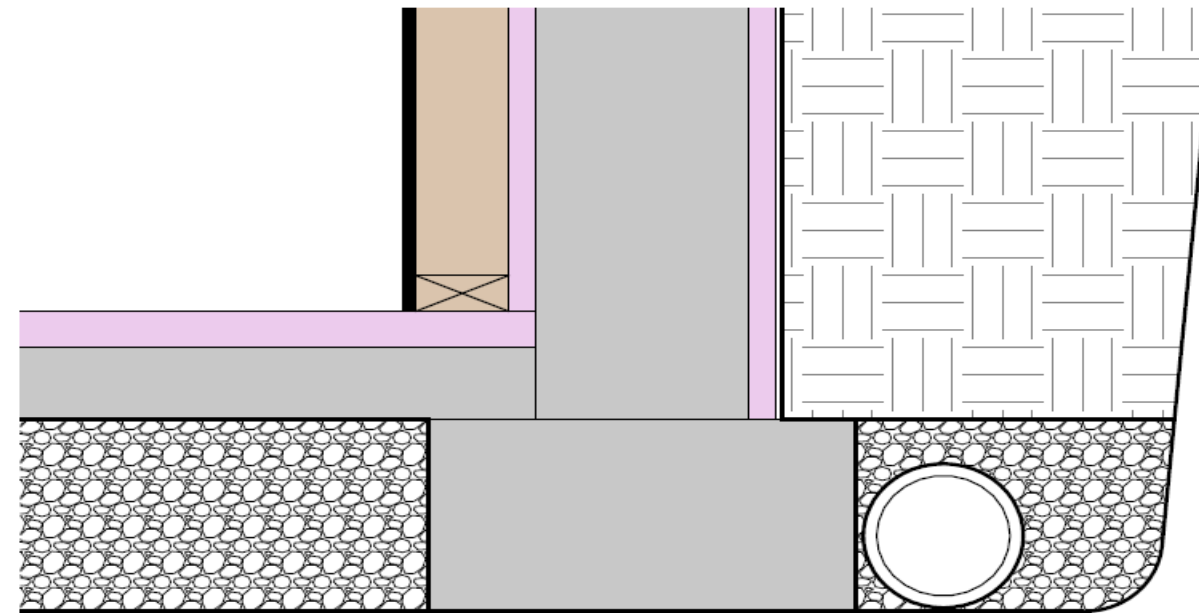
Wall Section

- Continuous Insulation from footing to attic
- Reduction in thermal bridging



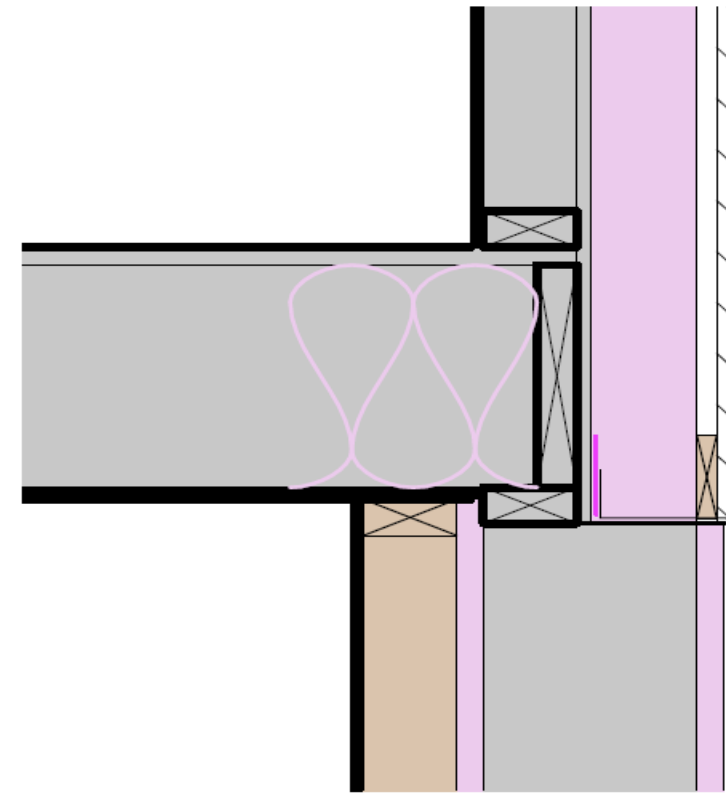
Basement Slab

- 1" Codeboard on exterior and interior of foundation wall
- Hardie board
- Insulation above slab
- Weep tile



Foundation Connection

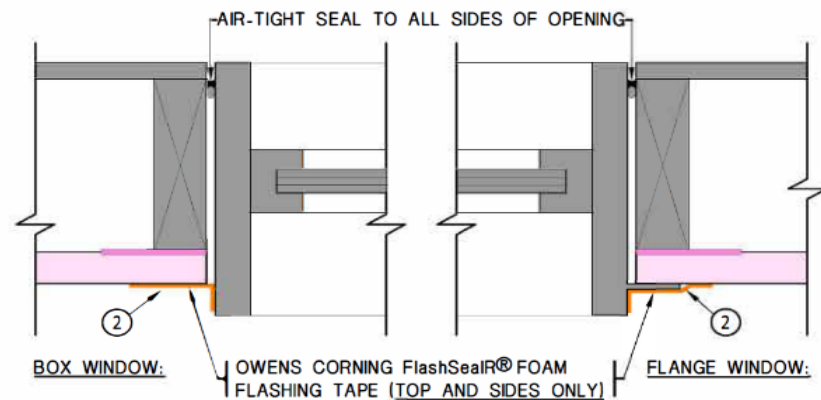
- Continuous insulation from foundation to exterior wall
- Insulating floor joists at rim board
- Light cladding



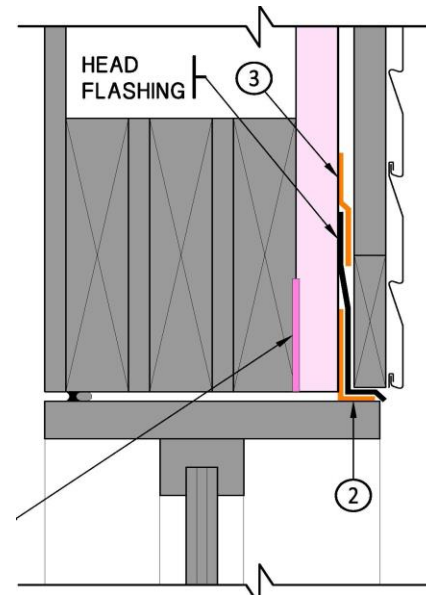
Windows

- FoamSealR Gasket
- Tuck vapour barrier
- R-5 Energy Star rated windows

PLAN DETAIL

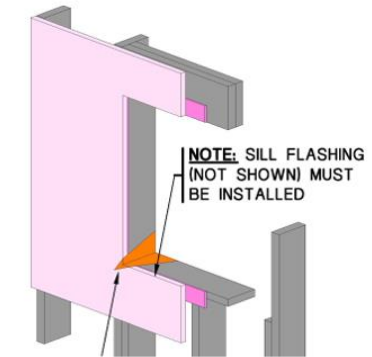


SECTION DETAIL

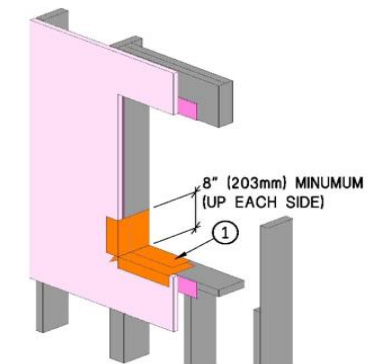


INSTALLATION

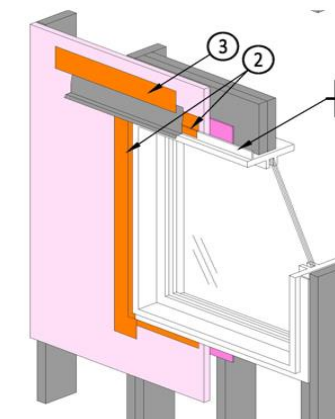
STEP 01



STEP 02

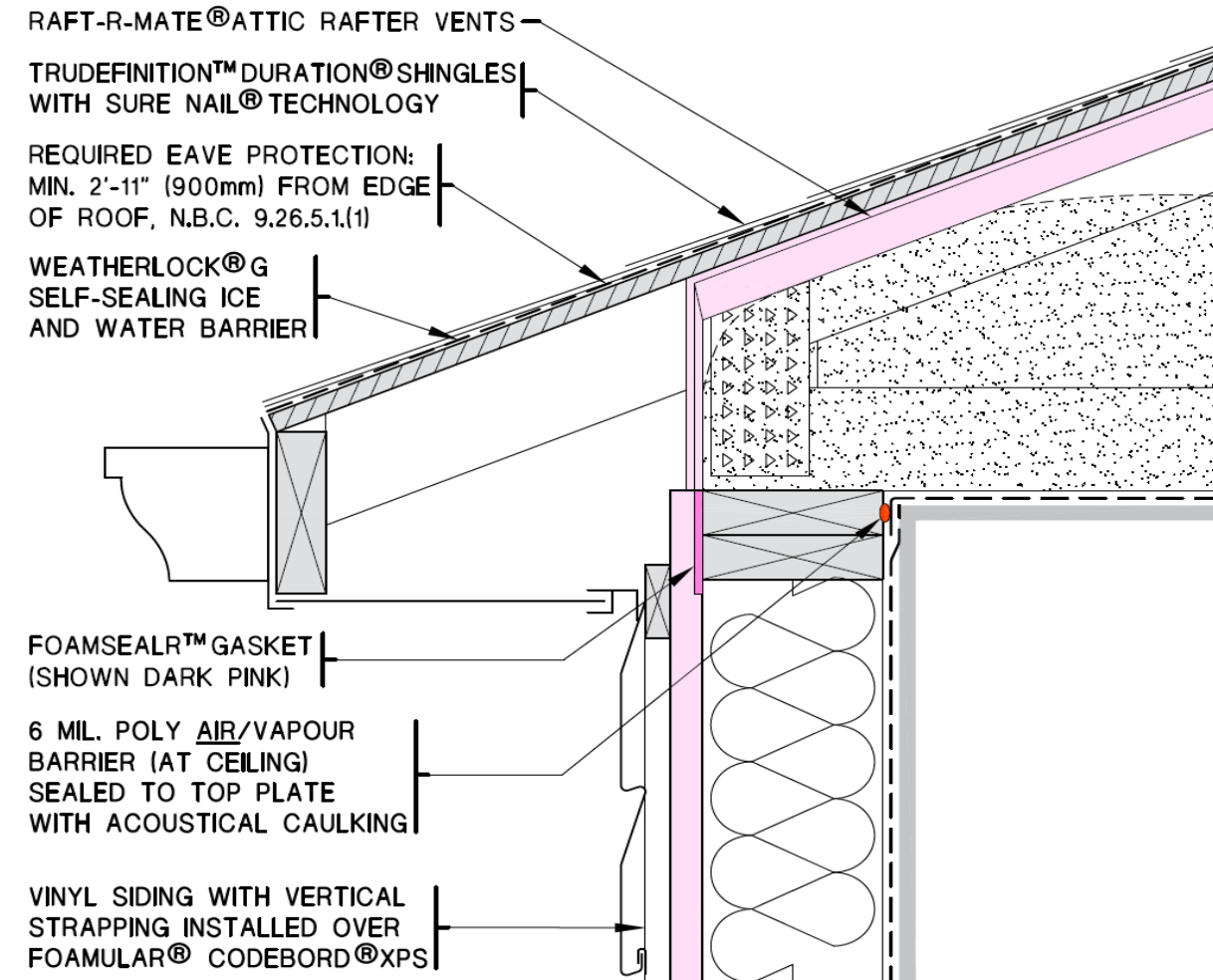


STEP 03



Attic

- Maintain existing where possible
- R-60 Owens Corning Propink blown fiberglass insulation



Design Concept

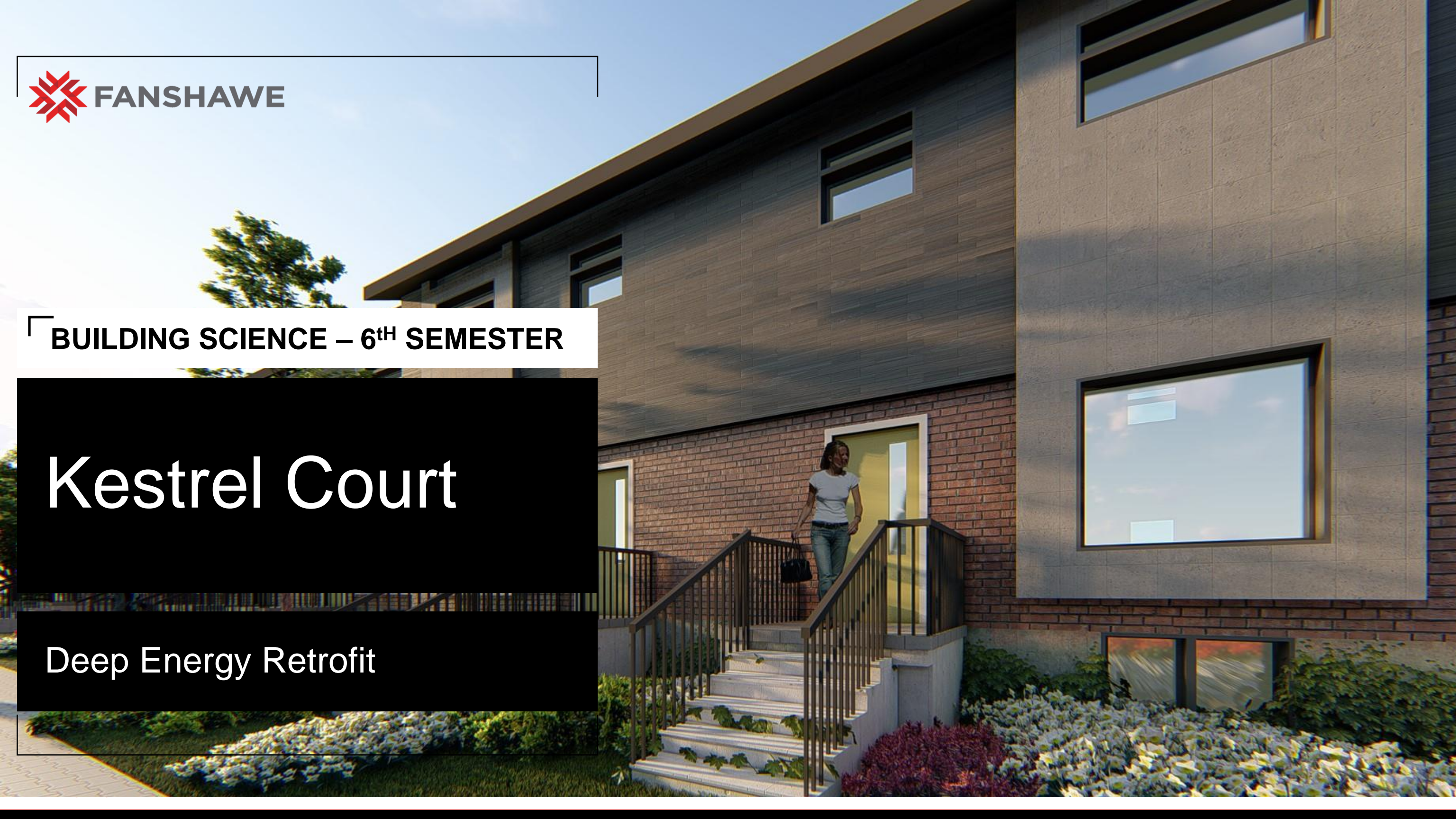




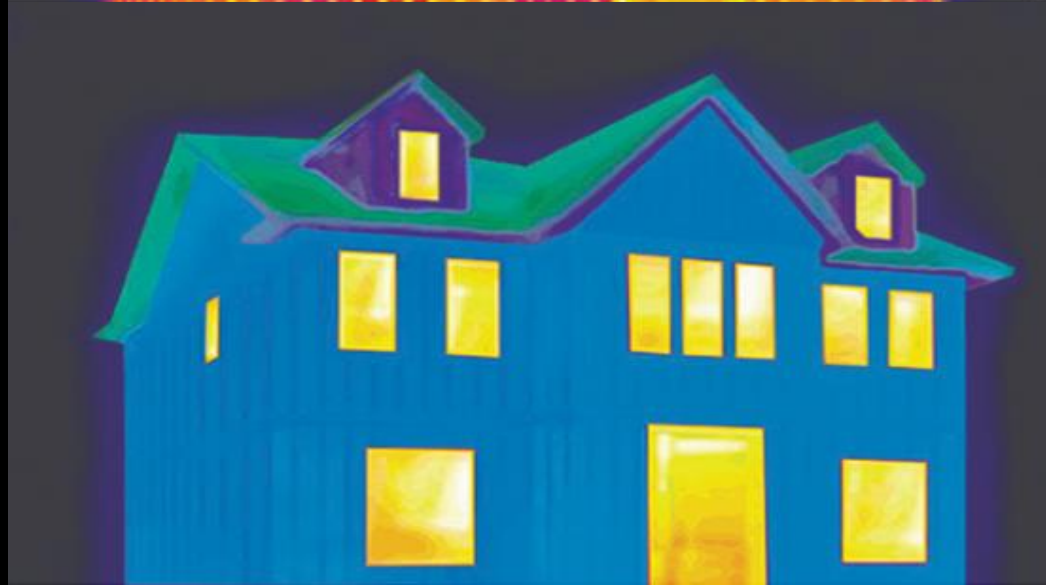
BUILDING SCIENCE – 6th SEMESTER

Kestrel Court

Deep Energy Retrofit



System



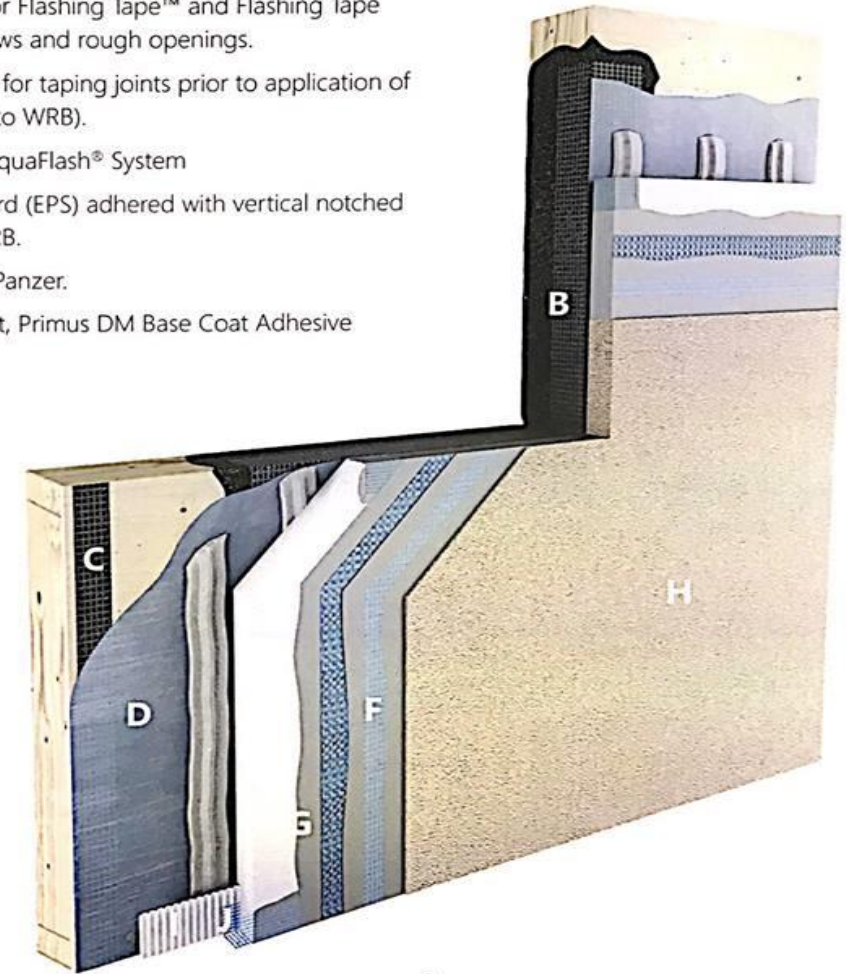
COMPONENTS

- A. Substrates:** Per code requirements and manufacturer's recommendations.
- B. Transition Membrane:** AquaFlash® System or Flashing Tape™ and Flashing Tape Surface Conditioner™ for treatment of windows and rough openings.
- C. AquaFlash® Mesh (Scrim Tape):** Mesh used for taping joints prior to application of water-resistive barrier (must be embedded into WRB).
- D. Water-Resistive Barrier:** Backstop NT and AquaFlash® System
- E. Insulation Board:** Expanded Polystyrene Board (EPS) adhered with vertical notched Stratum Guard® trowel configuration over WRB.
- F. Reinforcing Mesh:** Standard, Standard Plus, Panzer.
- G. Base/Adhesive Coat:** Primus® Adhesive Coat, Primus DM Base Coat Adhesive
- H. Finish Coat:** DPR and Specialty Finishes.
- I. Drainage Strip:** Adhered with dabs of Dryvit AP Adhesive
- J. Back wrapping**

FEATURES

- Intended for residential, wood framed construction
- Vertical adhesive beads from Stratum Guard® trowel facilitate moisture drainage
- Corrugated strip incorporated at the base of the wall and horizontal interfaces to facilitate drainage
- Incorporates a liquid-applied, air- and water-resistive barrier (optional vapour barrier)
- Engineered moisture drainage

STRATUM GUARD® |



original
THE CONTINUOUS INSULATION™



CCMC-12874-R

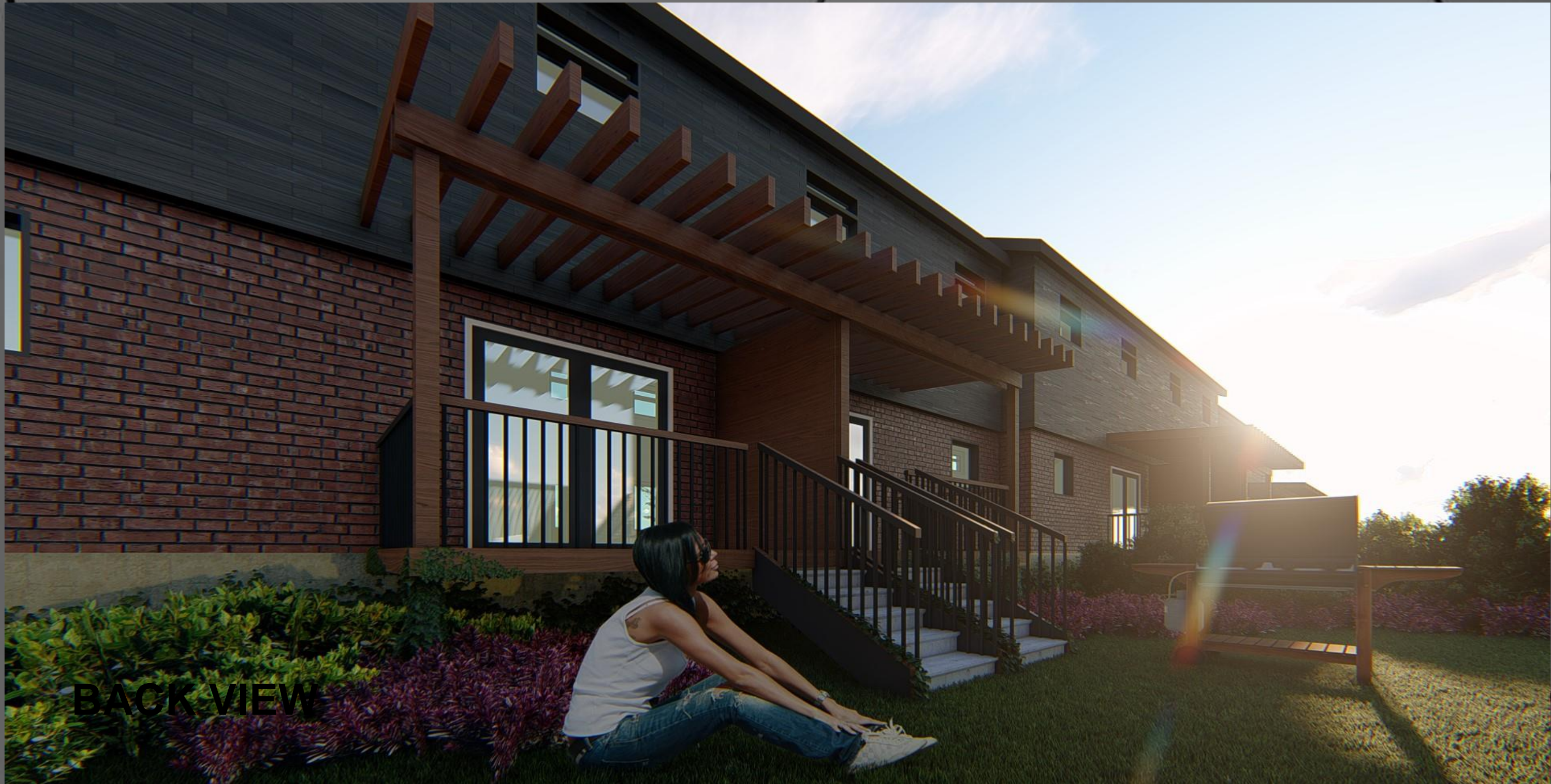
An RPM Company



FRONT VIEW



**ENTRANCE
VIEW**



BACK VIEW



<https://youtu.be/vrZWgtBv-L0>



Thank You

┌ **BUILDING SCIENCE – 6th SEMESTER**

QUESTIONS?

zimierz T. Kowalski
ARCHITECTS