

Heating in NZEH homes



Electric baseboards

- Cheap
- Even heat
- Relatively inefficient
- Incompatible with AC

Heating in NZEH homes



Gas-fired combos

- Cheap
- Even heat
- Compatible with cooling
- R&D needs:

Improve efficiency



Heating in NZEH homes



Mini-splits

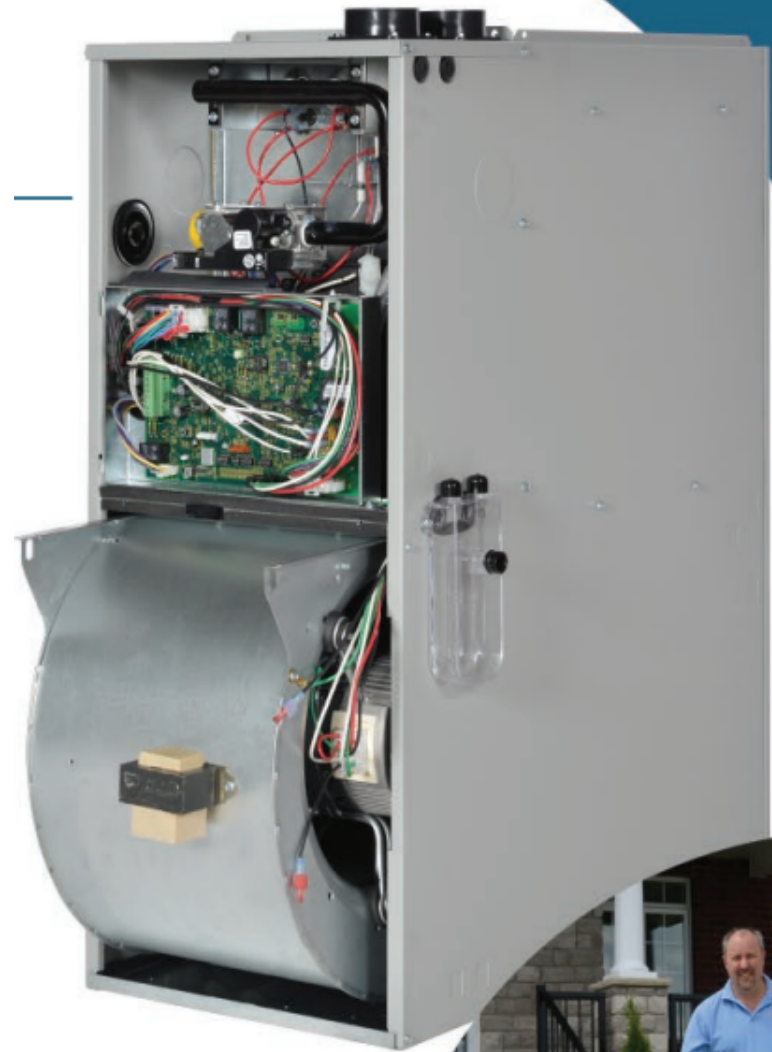
- Relatively efficient
- Provides AC
- R&D needs:

Even heat distribution

Promising products
might fill this niche:

Dettson gas furnace
4.3 kW, 96% AFUE

<http://www.dettson.ca>



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Barrier # 4: Grid connections



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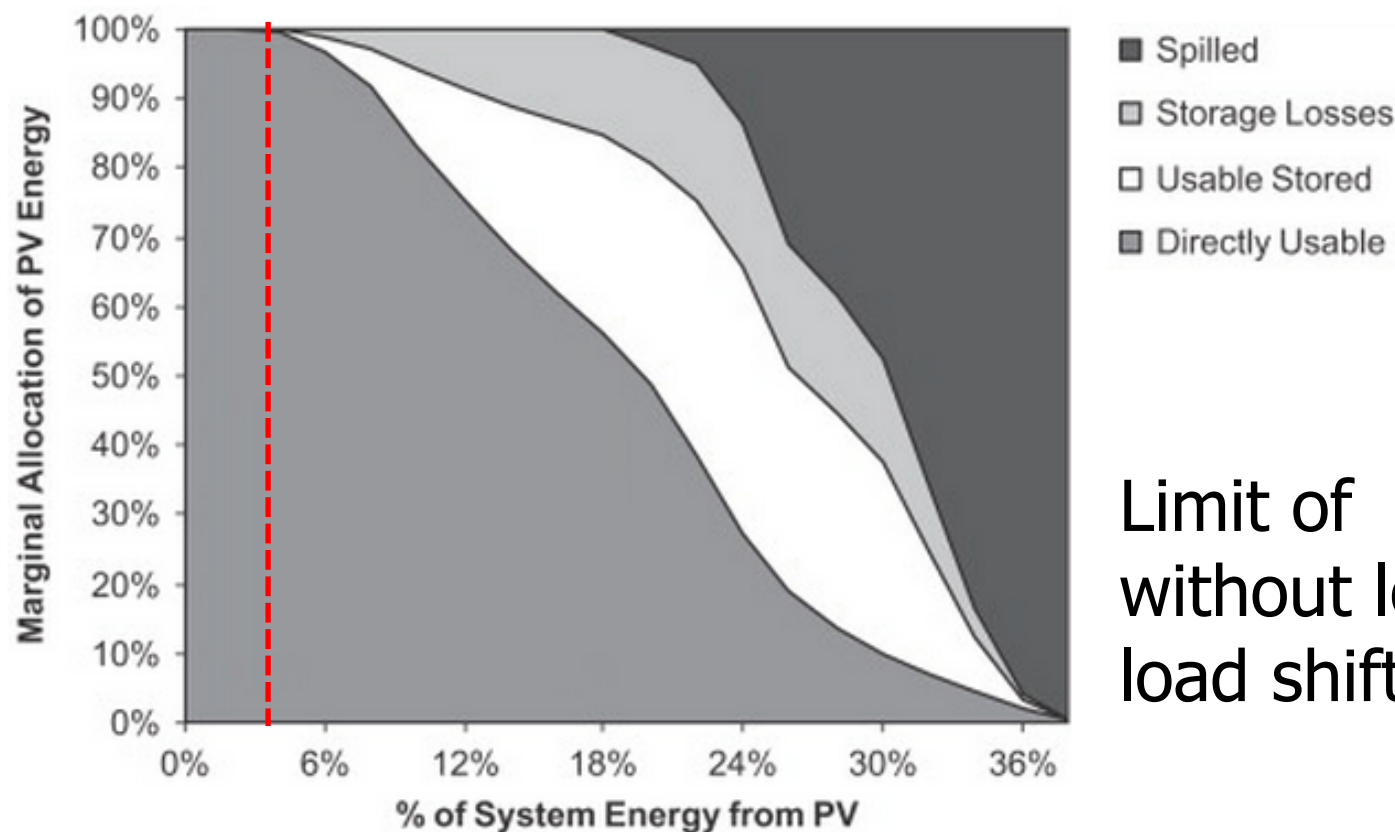
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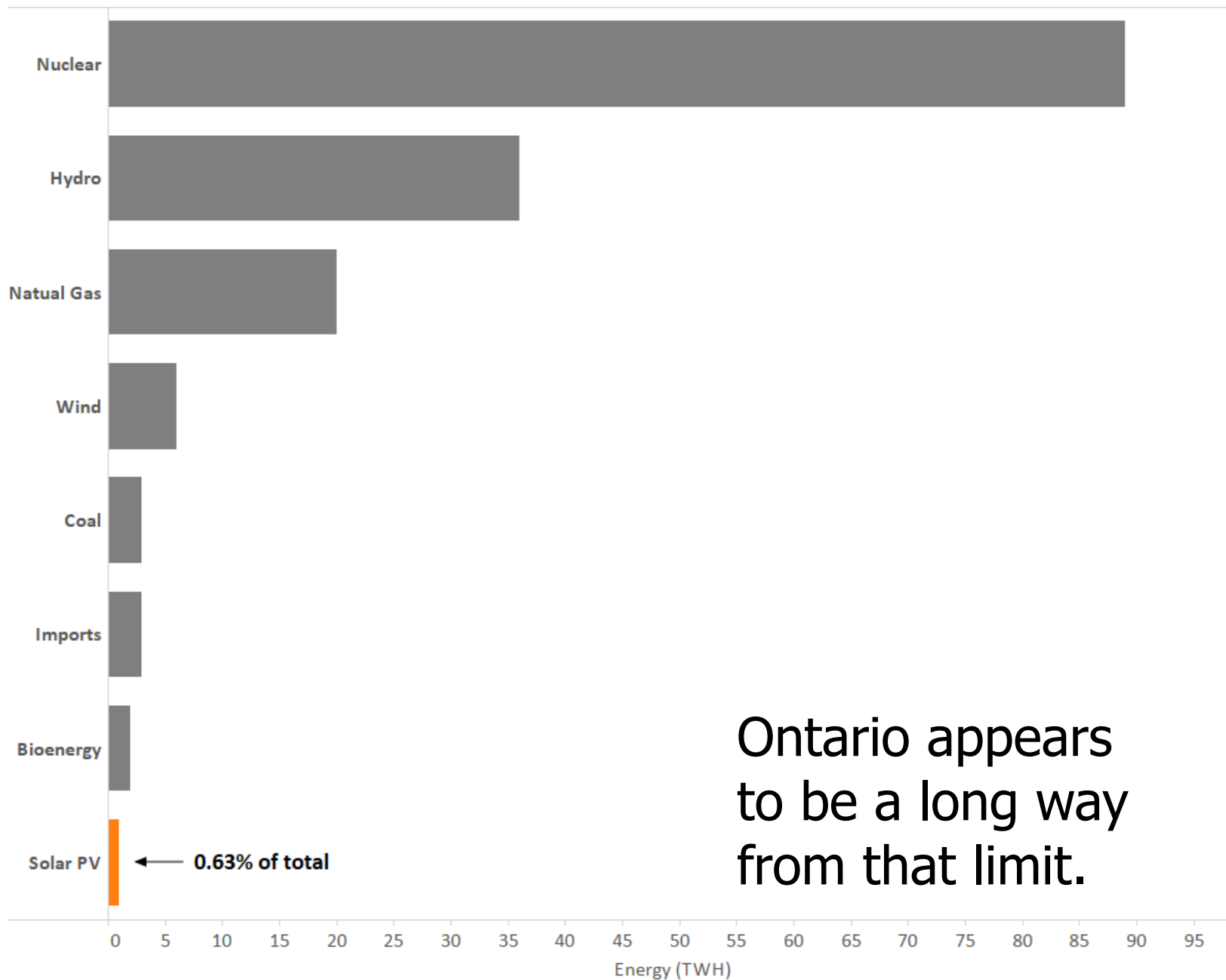
How much PV can the grid absorb?

Denholm & Margolis, 2007

Evaluating the limits of solar photovoltaics (PV) in electric power systems utilizing energy storage and other enabling technologies, Energy Policy, Volume 35




Limit of PV penetration without loss, storage or load shifting: **~5%**



Ontario appears to be a long way from that limit.



But PV grid-connections are conditional on utility & LDC capacity



Capacity Evaluation Tool

Version 1.5 (Data Updated on 2013-11-7 >>> Data Expires on 2013-12-18)

Proposed Project Data

Connecting Station / Feeder:

Project Size: kW

Technology:

RESULT **Fails**

Test 3 failed @ feeder.

See the Failure Message Details tab for more info.

In order for Hydro One to confirm capacity availability and allocate capacity to your project, you will have to apply to Hydro One for connection using Form B or Form C.





Utilities need solutions that show NZE-housing isn't going to over-burden the grid

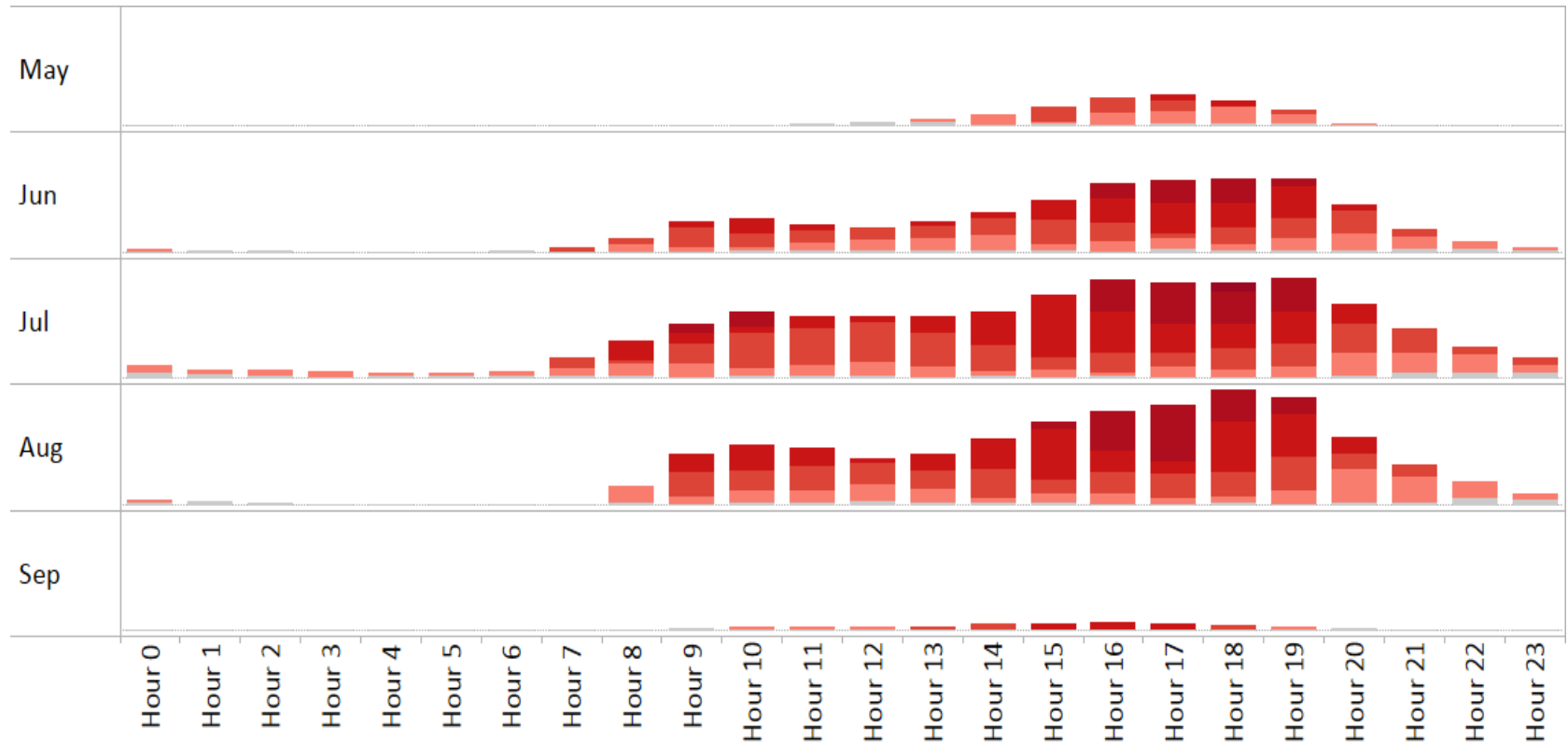


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We can optimize time-of-use to design homes that are more attractive to utilities and LDCs.



Maximize utility conservation dollars & turn Net-Zero homes into assets

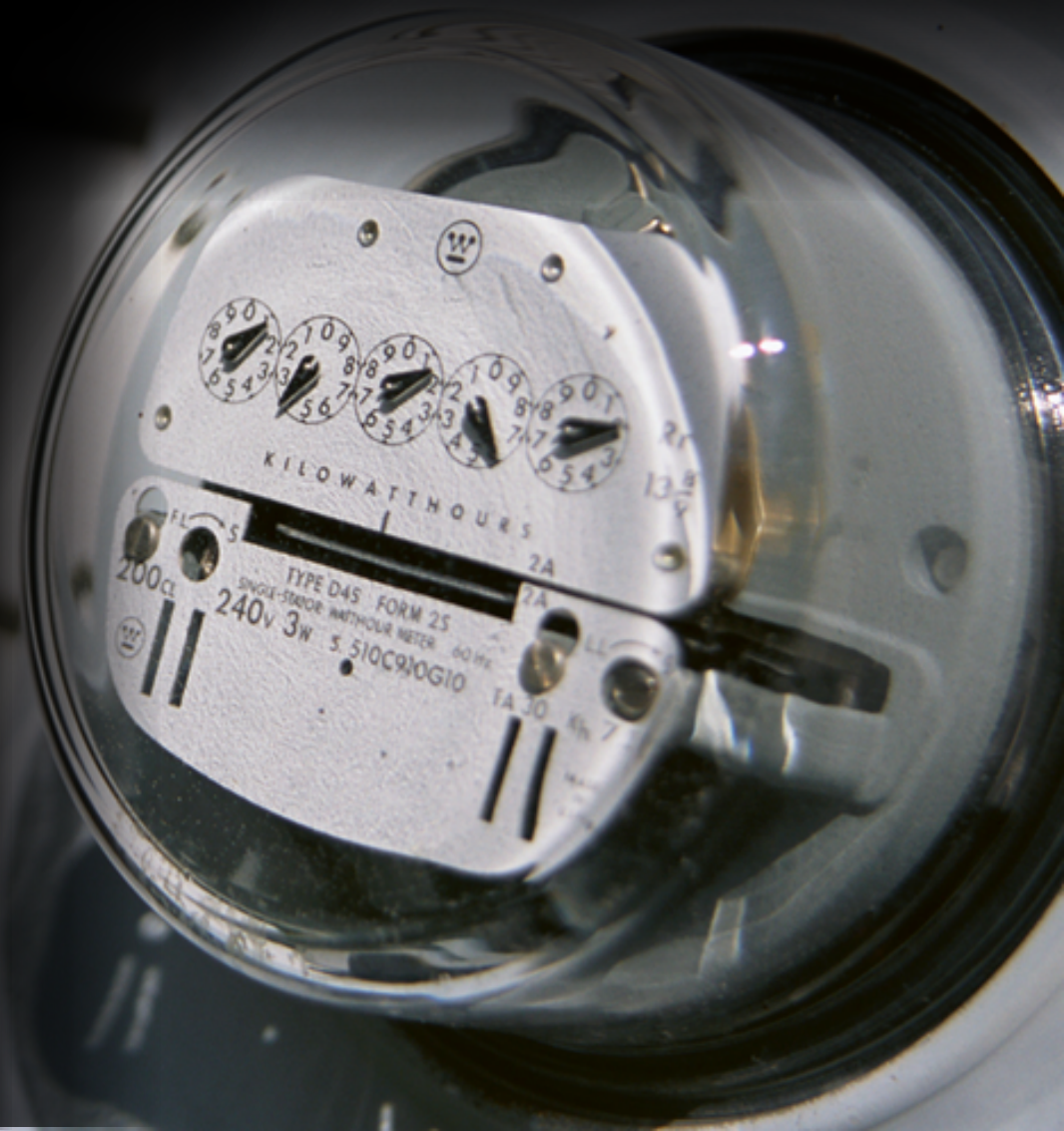


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Barrier #5: Utility rates



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Economics depend on utility rates



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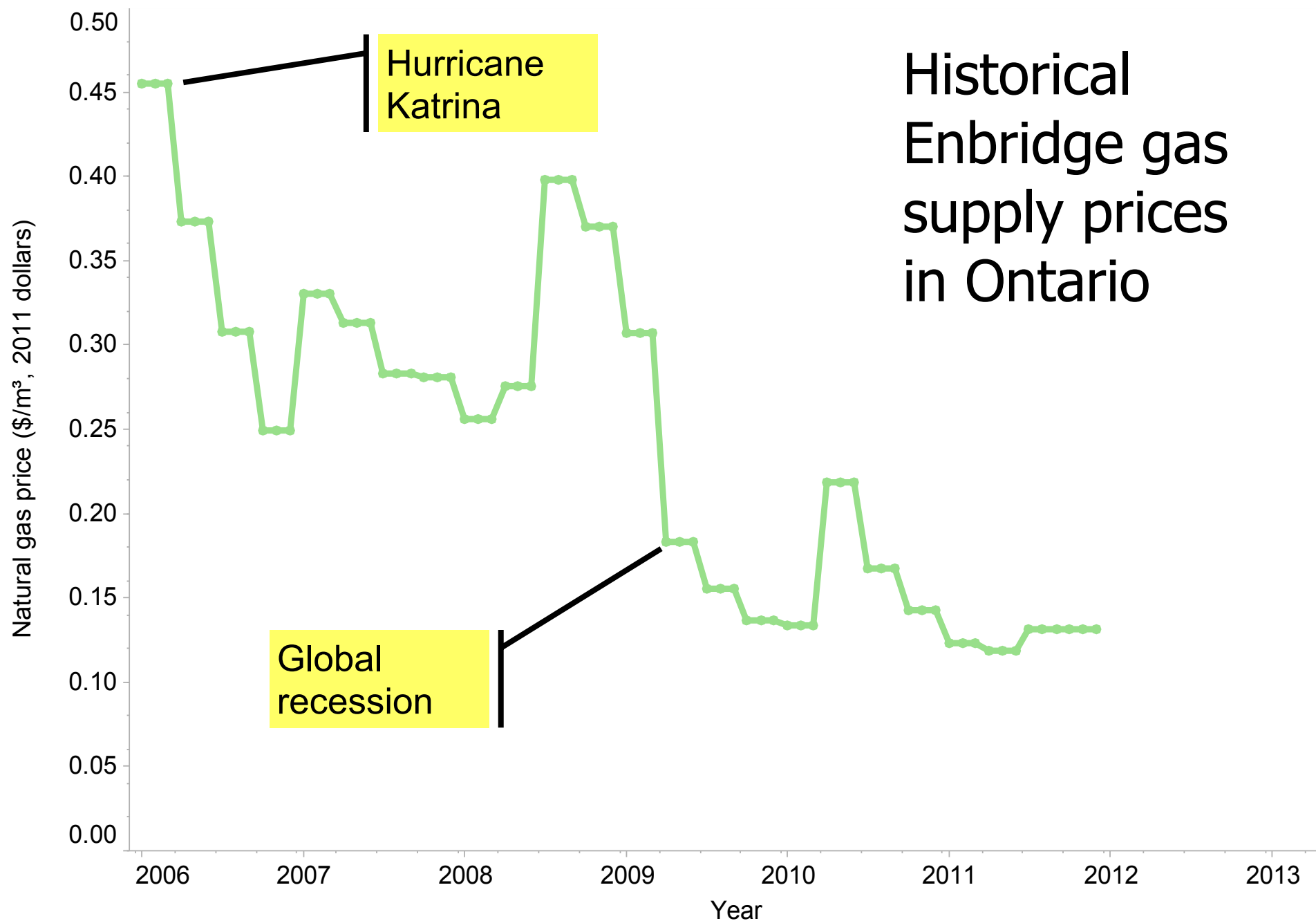
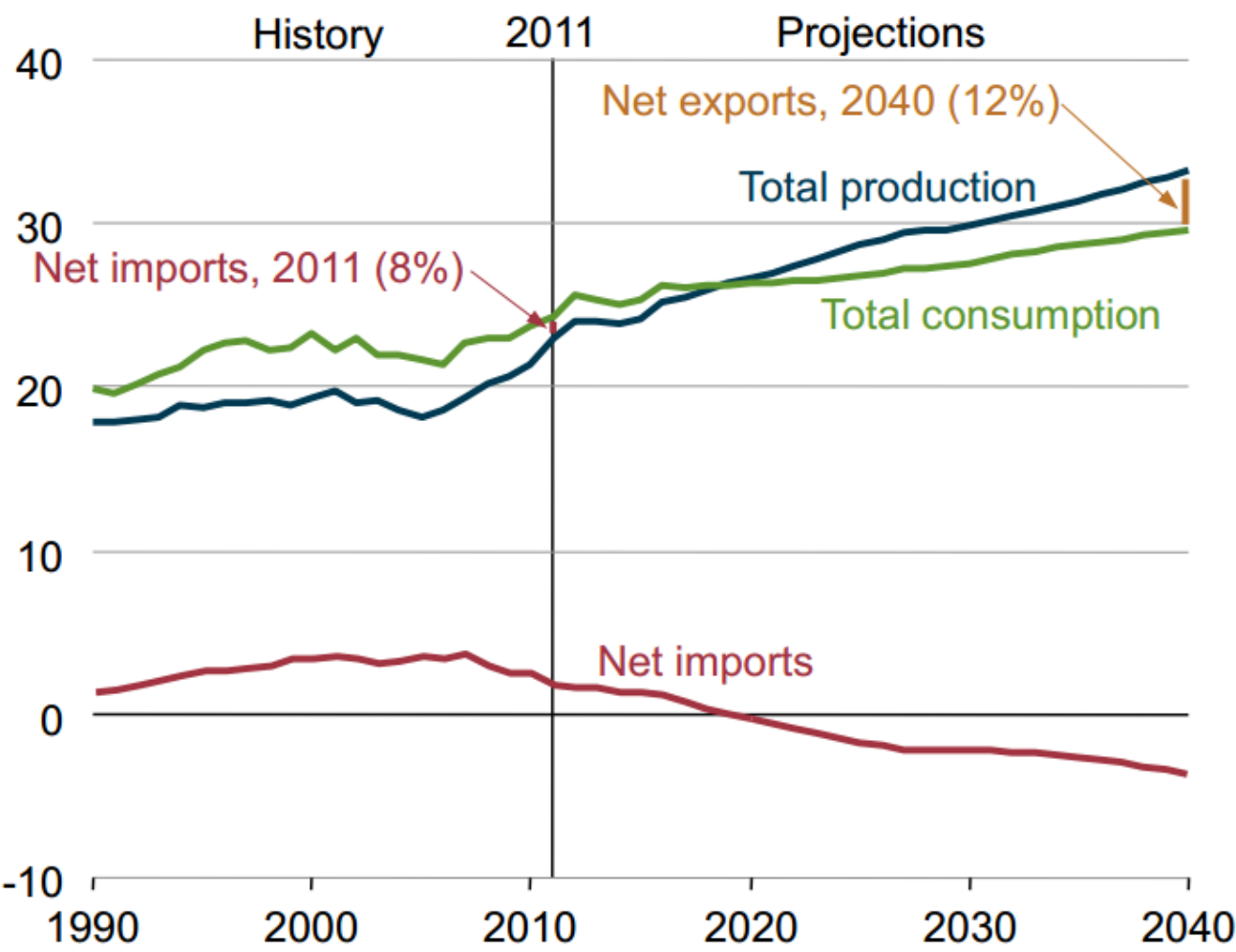


Figure 2. Total U.S. natural gas production, consumption, and net imports in the Reference case, 1990-2040 (trillion cubic feet)



US production predicted to exceed demand in 2020

More cheap gas to more Canadian markets?

<http://www.eia.gov/forecasts/>

#5: Can any home achieve Net-Zero?

Should every home be net-zero?



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Every House Can Achieve the NZE Goal...

...if you have a large enough solar PV system on it.



Drawing credit: Peter Amerongen



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**Not so
far-fetched!**



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Put PV everywhere!



2009 Solar Decathlon Winner

- 1000 sq ft.
- **\$650-850K cost**
(no foundation)

New rule for 2011: Affordability

*“A jury of professional cost estimators shall assign an estimated construction cost to each project. **All available points are earned for achieving a target construction cost of \$250,000 or less.** No points are earned for a construction cost at or above \$600,000.”*



Can any home achieve Net-Zero? No.

Should every home be net-zero? No.

Home buyers



Home builders



Utilities



**The benefit of net zero will not always
be attractive enough to justify the investment**

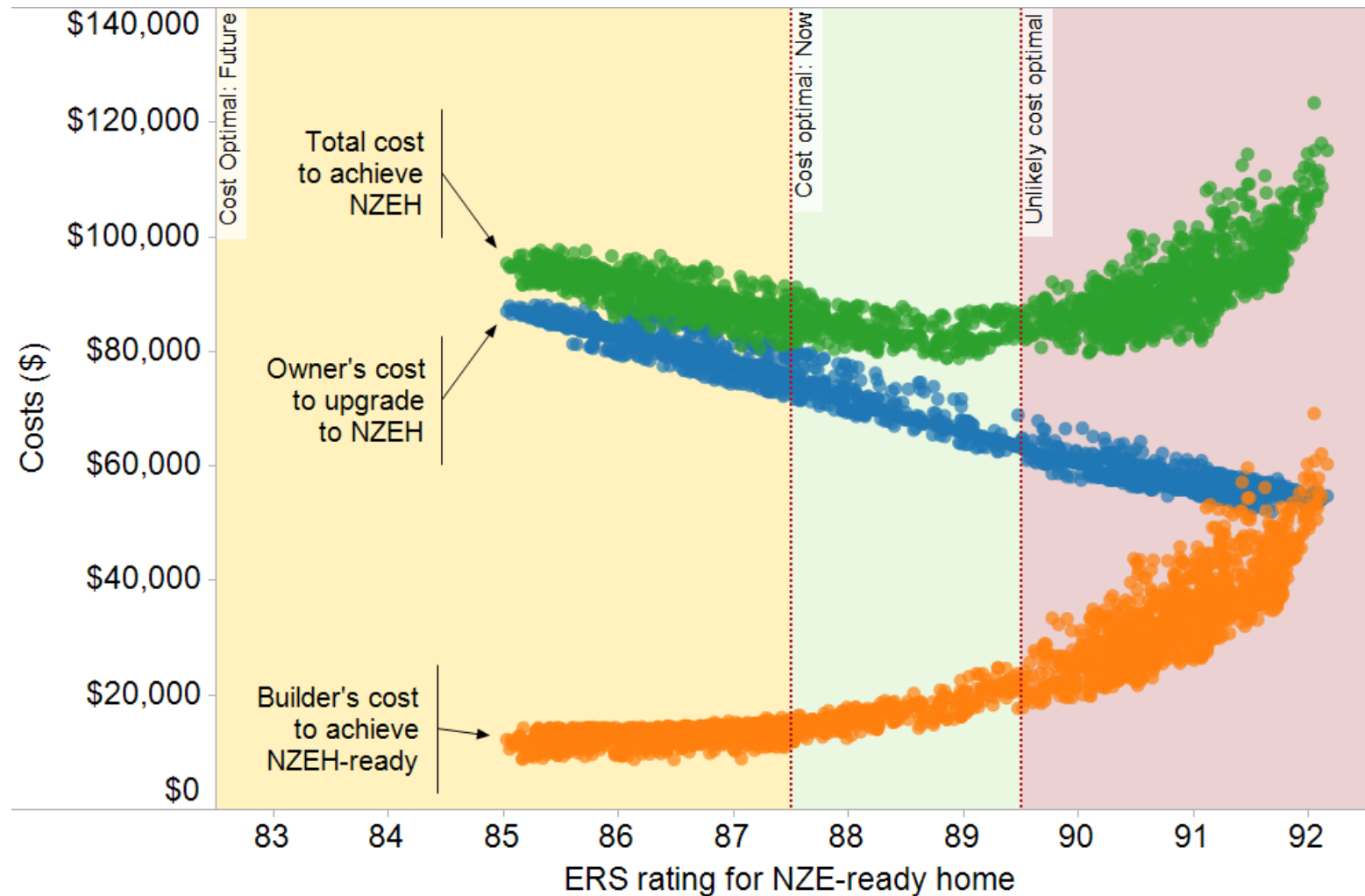


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What about Net-Zero Ready?

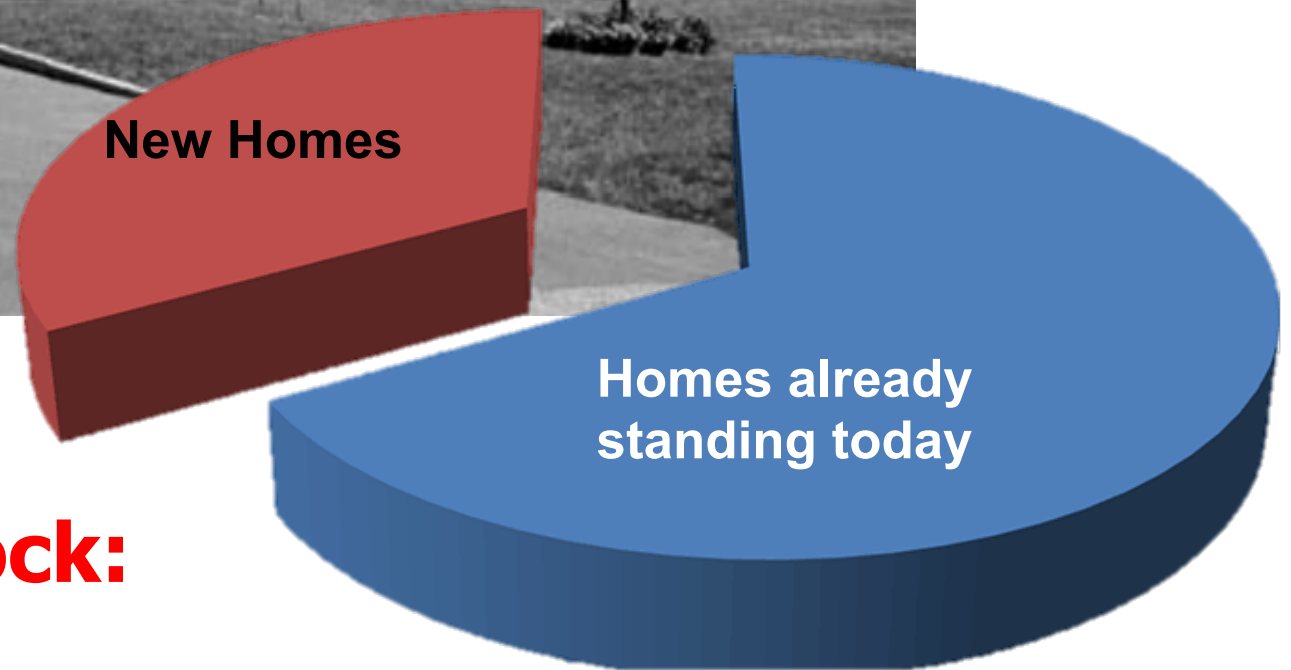


Legend

- Construction costs for Net-Zero-Ready
- Upgrade cost to achieve Net-Zero
- Total cost of Net-Zero

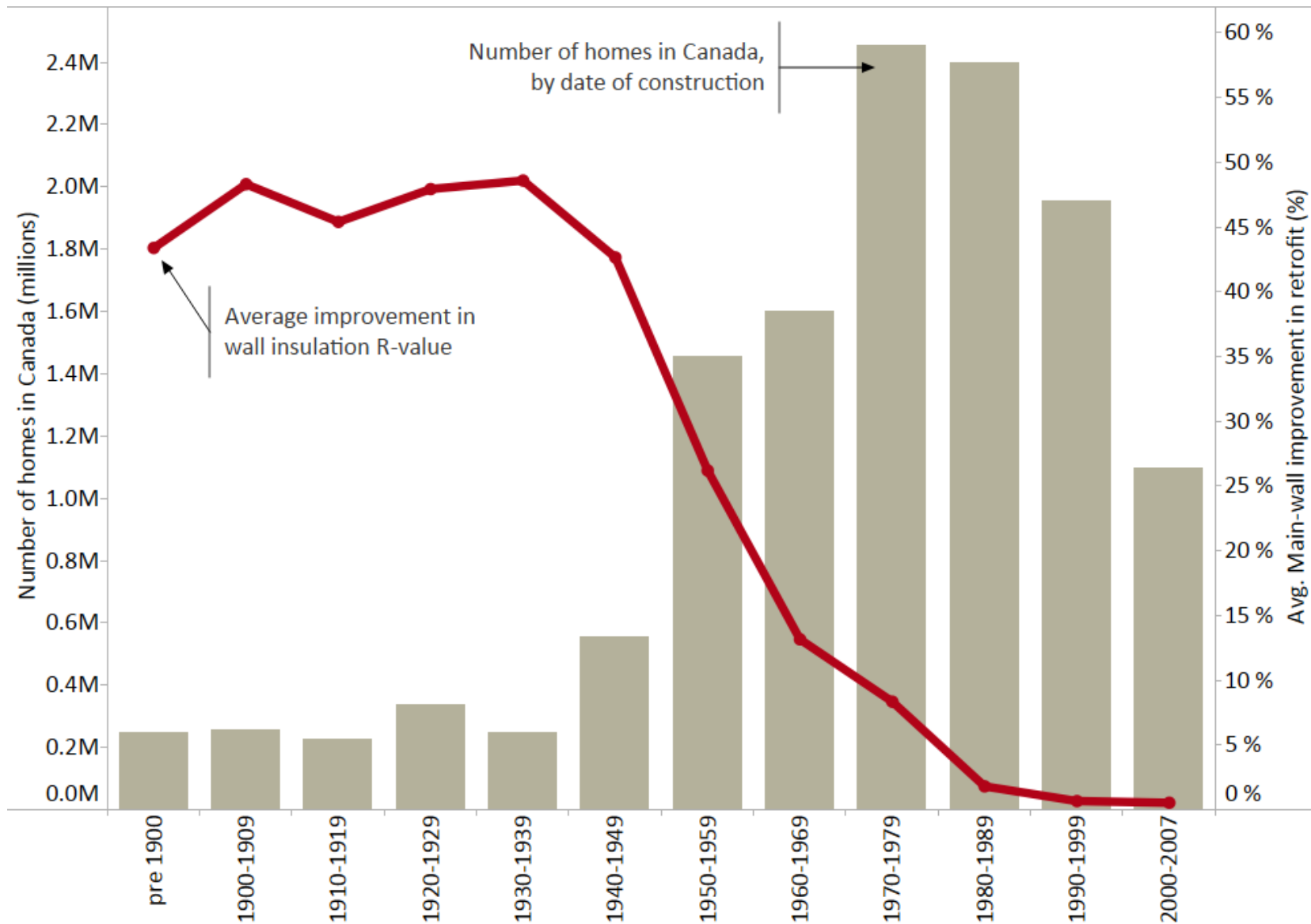


#6: What about existing homes?



**The 2050
Housing Stock:**





■ Number of homes in Canada, by decade of construction
■ Average improvement in main-wall insulation during retrofit

The Retrofit Opportunity



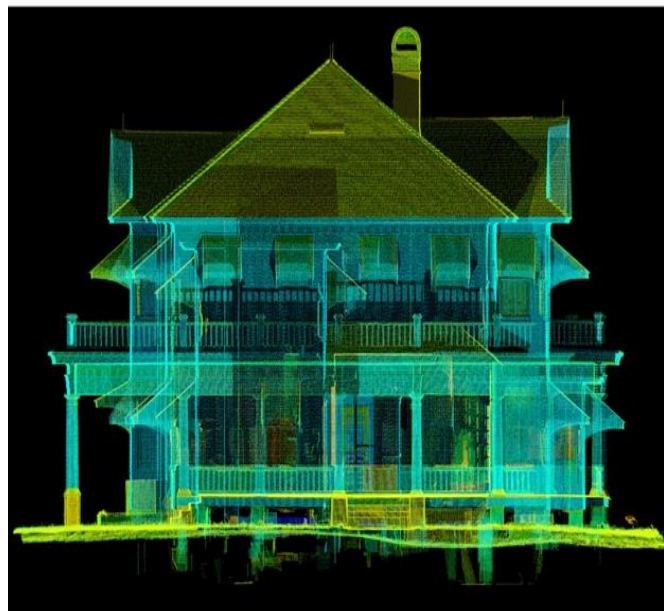
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How do we transform renovation?

Move it into the factory!



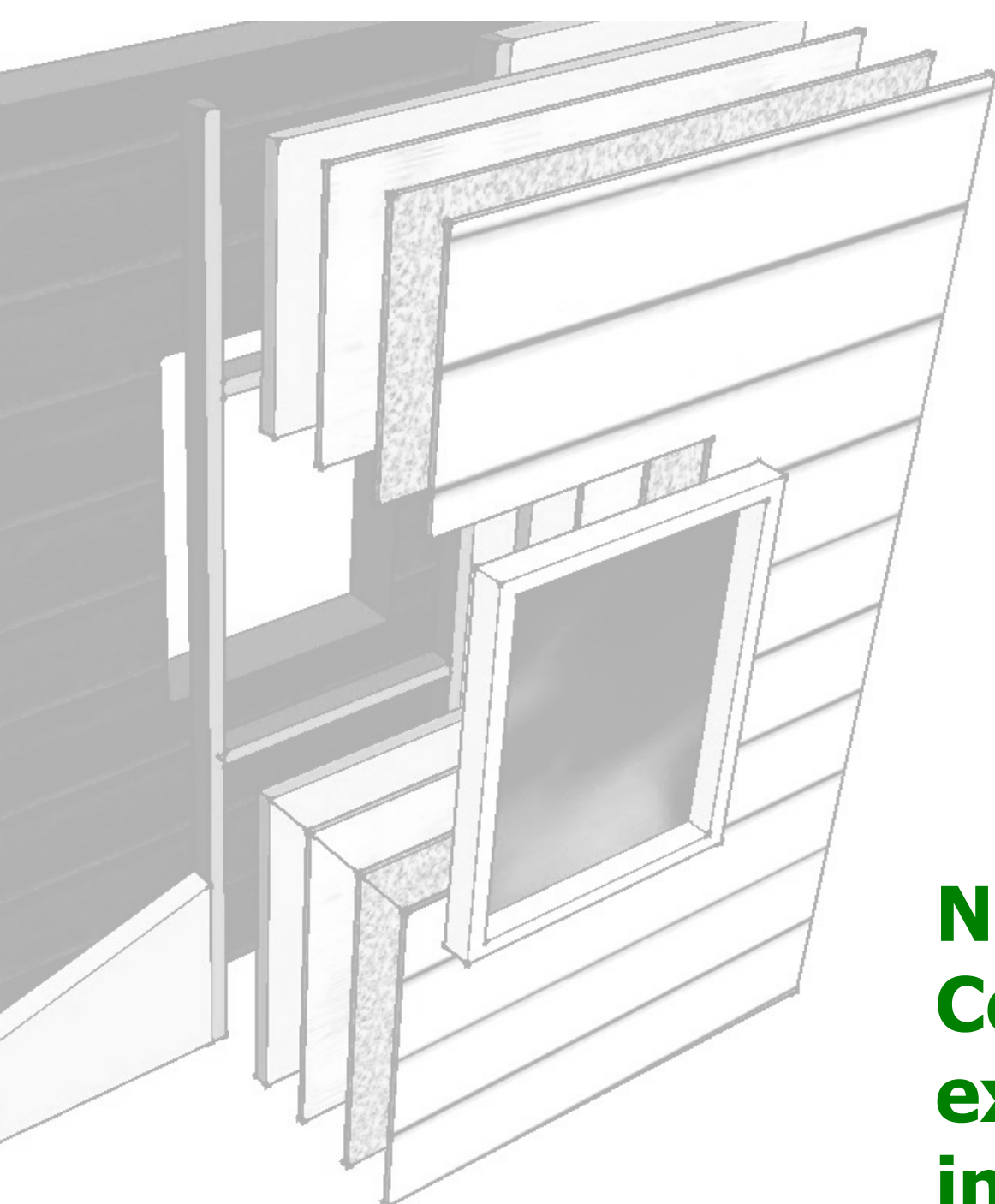
Laser dimensioning enables panelized wall retrofit



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**New wall systems
Could go over top of
existing cladding and
include VIPs.**



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Benefits go beyond utility bills



Images: Todd Smith

Exterior Retrofits offer highest
renovation cost recovery rates **73%**

*Remodelling Magazine,
Cost vs. Value report 2013*



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#7: So What?



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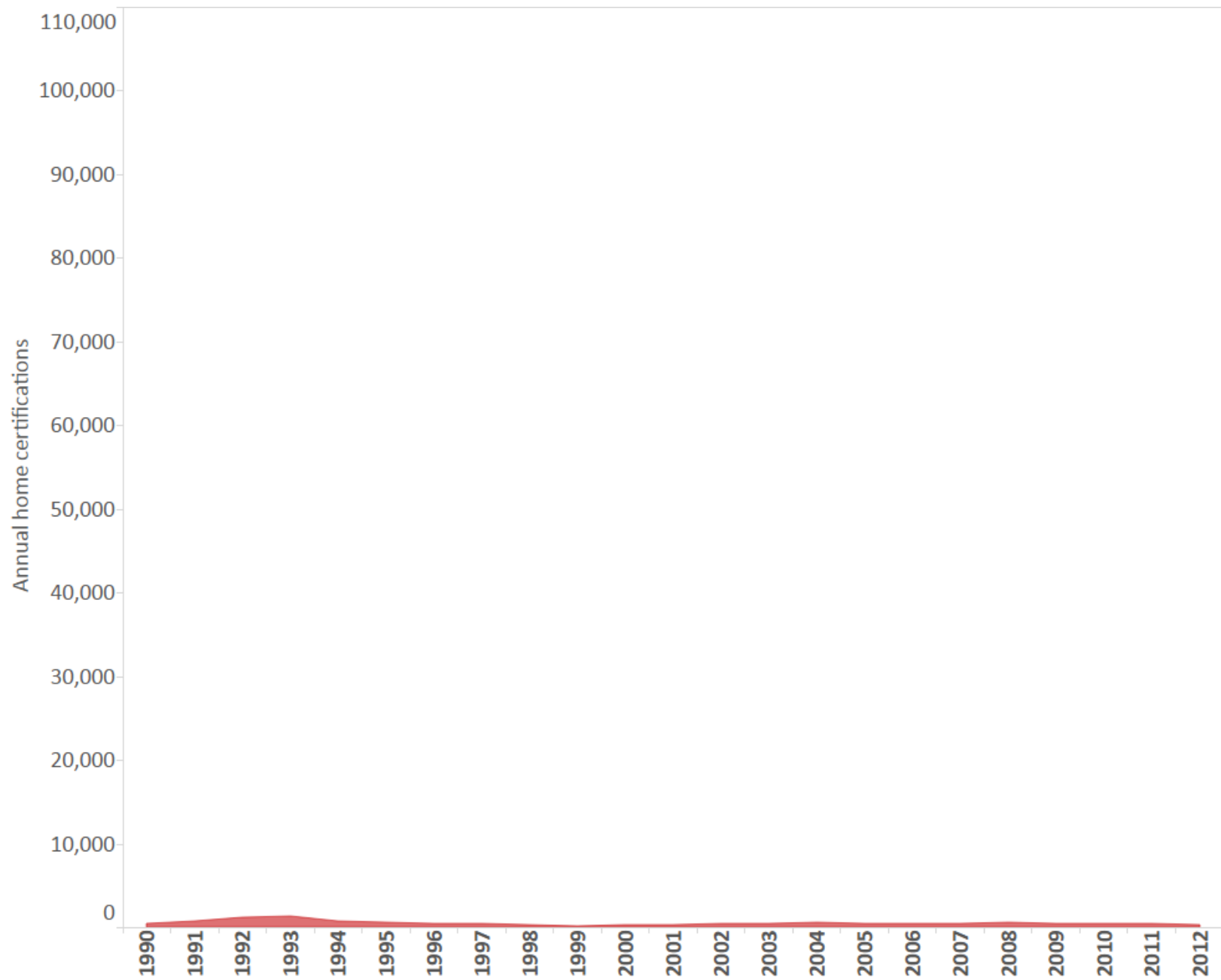
R-2000 is about exploring advanced technology in real applications.



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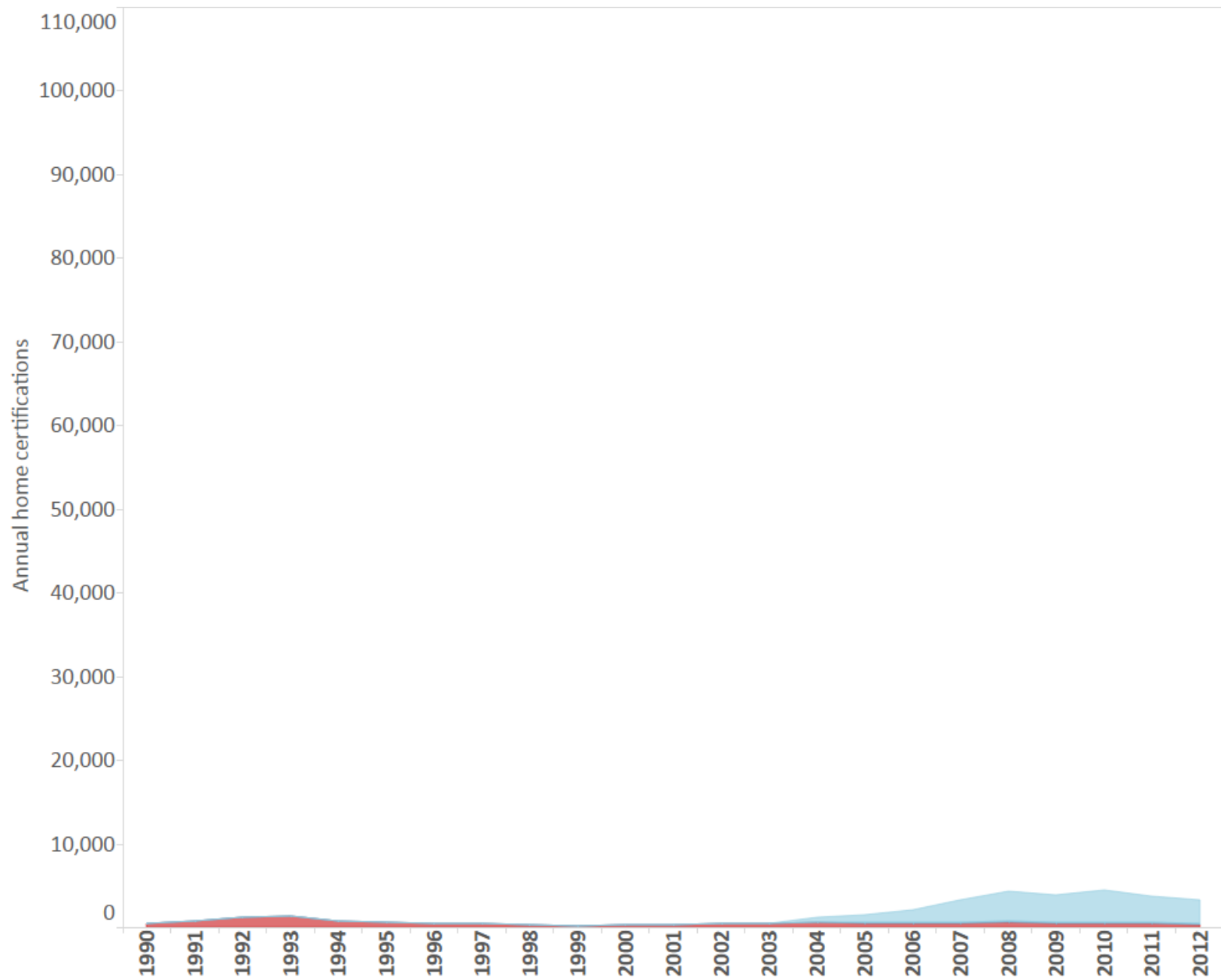
R-2000



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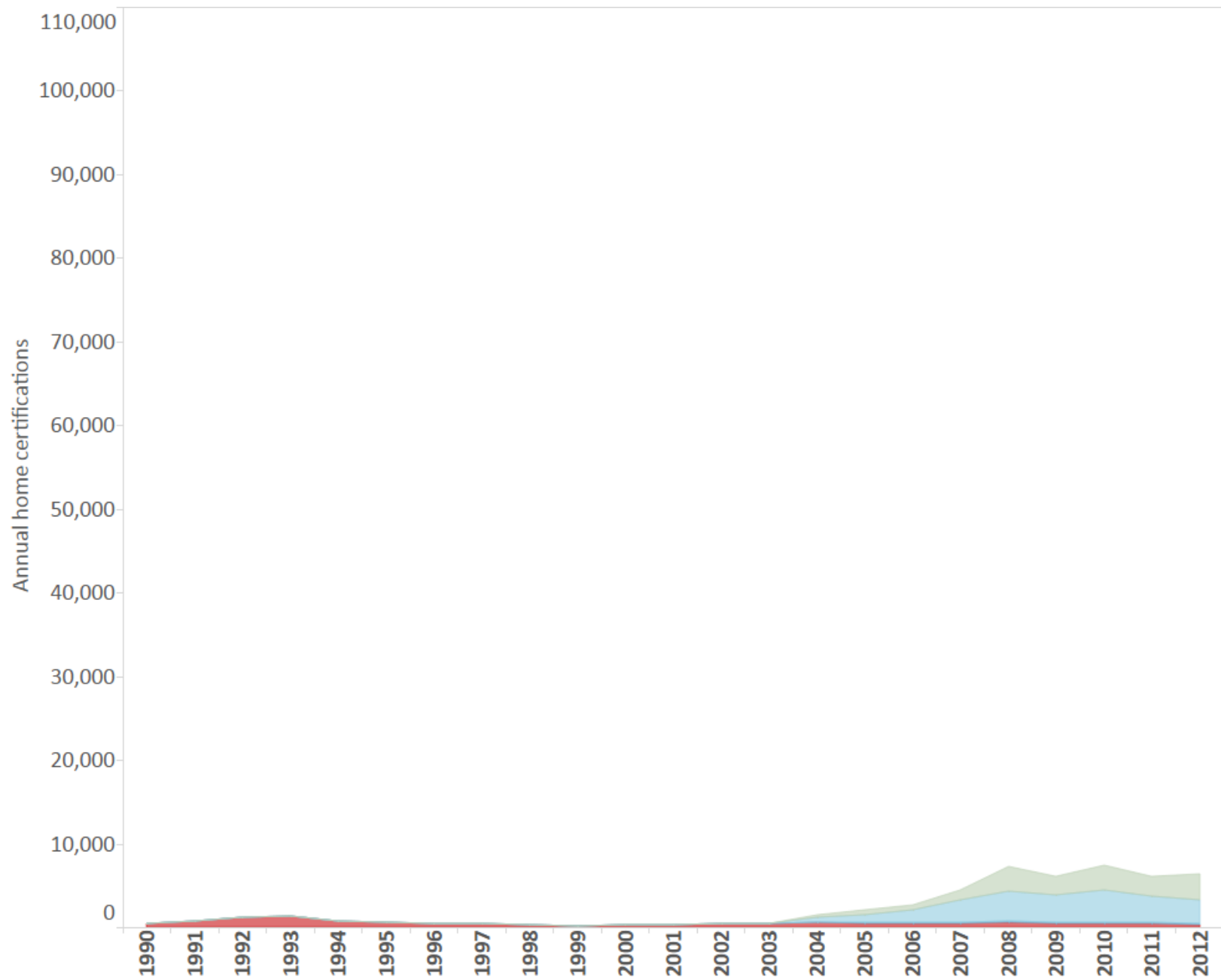
**Novoclimat &
Power Smart**



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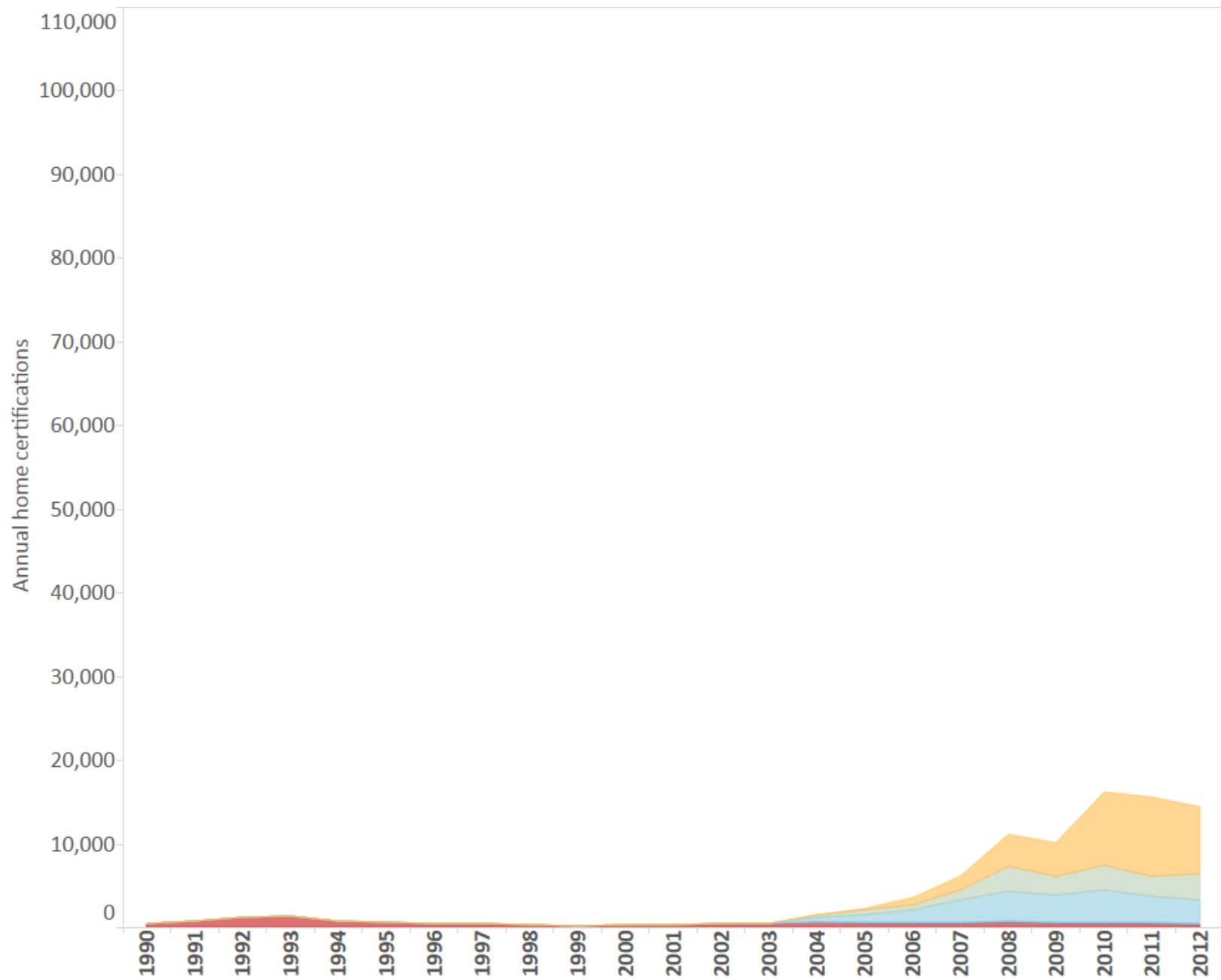
Built Green



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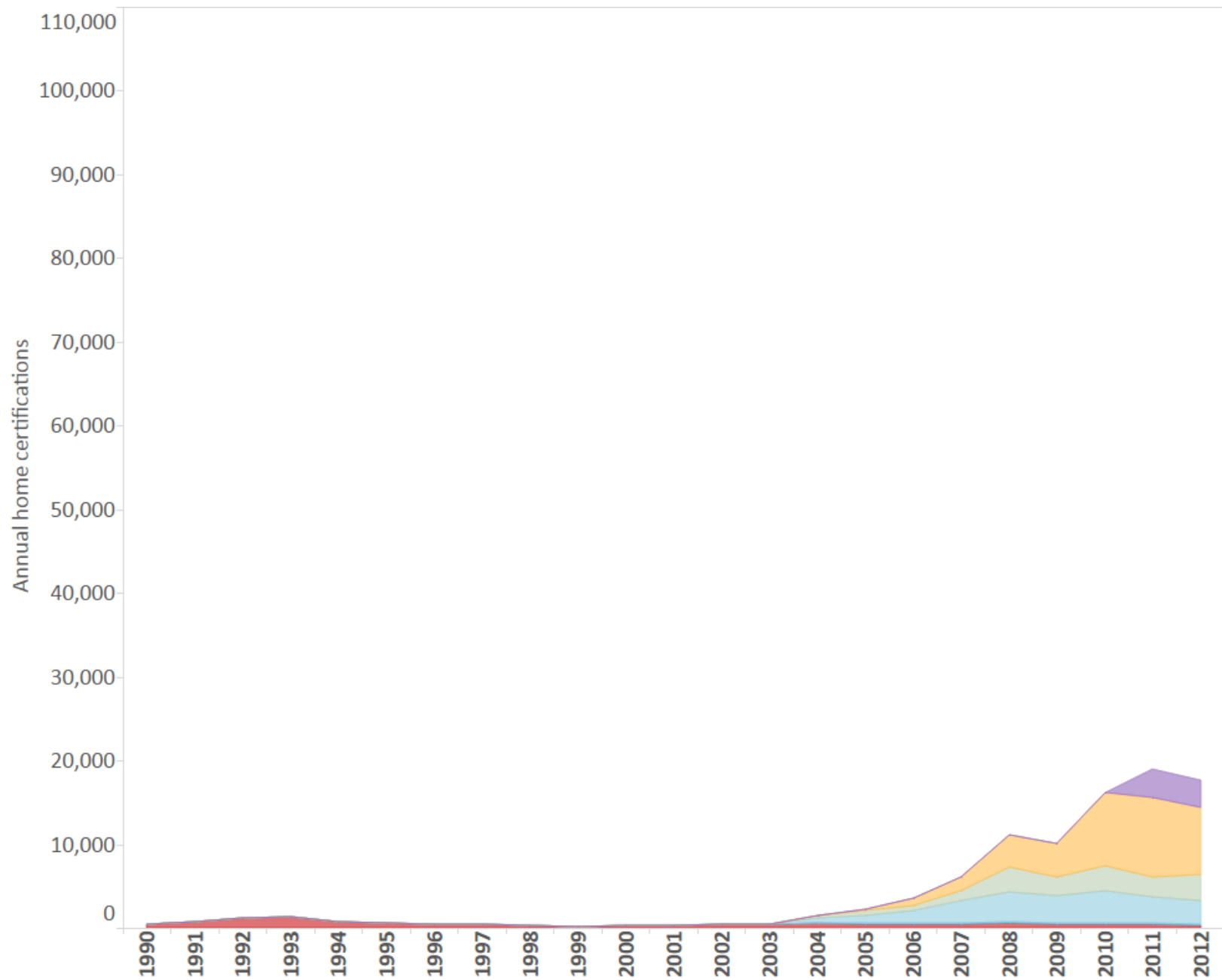
Energy Star



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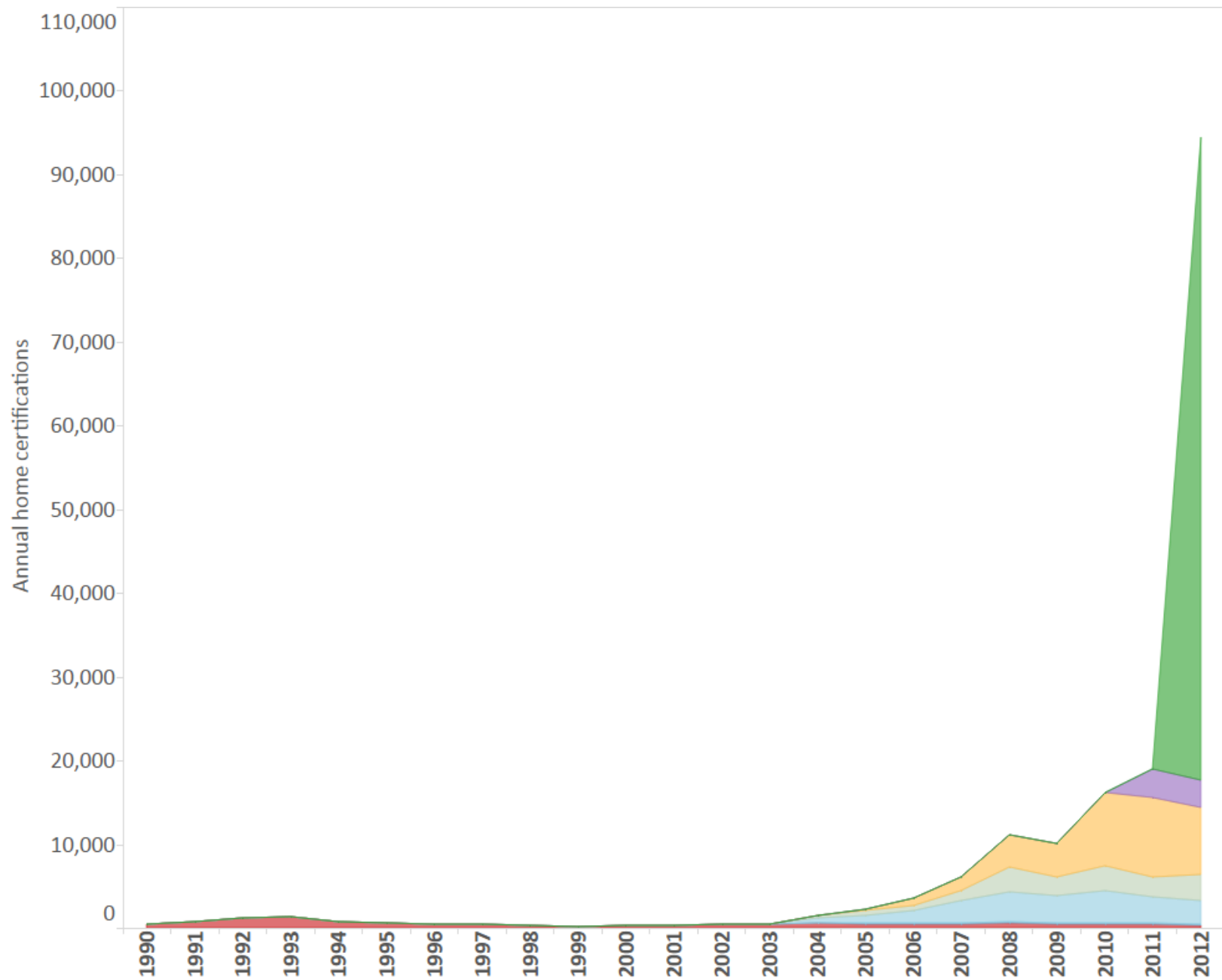
**Nova Scotia
2011 building
code**



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**2012 Ontario
building code**



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2012 midscale update to the National Building Code incorporates many elements of R-2000





A Net Zero Project Belgravia Green

Tour Dates
on Website

These three homes use
state-of-the-art technologies
with the goal of producing as
much energy as they consume.



www.effecthomes.ca

**Net-Zero Energy Homes
provide the solutions needed
to renew next-gen programs & codes**



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Questions:
housing.research@nrcan-rncan.gc.ca



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