Energiesprong

Adapting a Dutch Approach to Deep Energy Retrofits to in New York State

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Social Housing

- widespread, dates to building booms post WWII
- owned by not-for-profit social housing agencies

What does it look like?

- rectangular blocks, a form of row housing
- small front yard, with a front entrance facing the street, in other words an entrance directly from outdoors (no common corridor)
- two-story, each unit having a downstairs (mostly living areas) and an upstairs (mostly bedroom areas)

from top to bottom

Roofing

- almost always slate tile over wood framing; usually a simple gable

Attics

- used as a third floor for a dormer bedroom, storage, or location of existing mechanical systems (boiler and water heater)
- not vented

Foundations

- concrete and uninsulated
- crawlspaces are common, shallow, accessible from inside the house, and typically vented

Walls

- typically brick, in two wythes, separated by an air gap. Existing walls are typically not insulated
- interior floors/ceilings are typically concrete. Interior walls are masonry with plaster finishes.
- kitchen is often located behind the entrance. A living room, with dining area, typically runs the full depth of the house, on the first floor

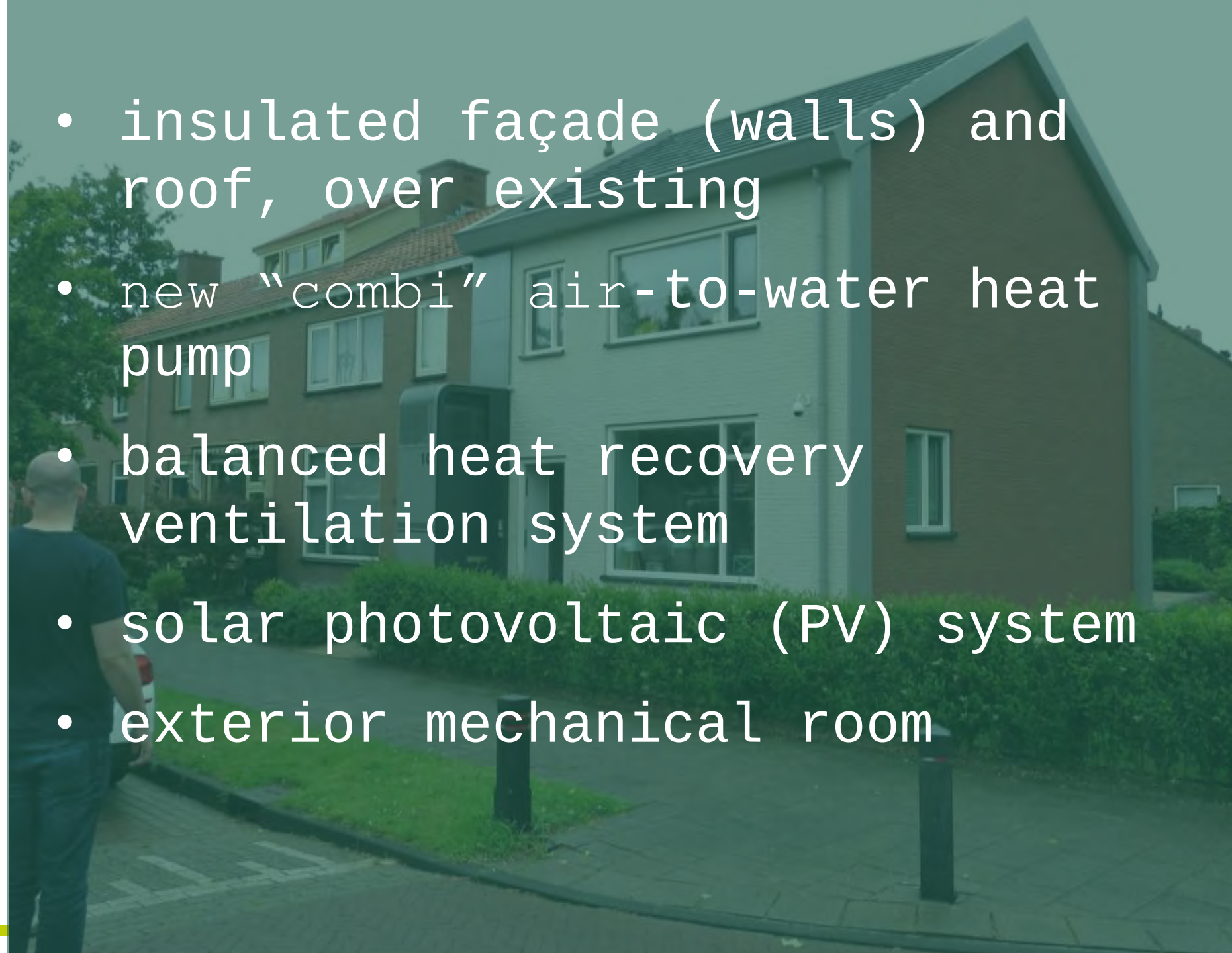
Non-standard facades and other features

- balconies (recessed or protruding), dormers in roofs, awnings, decorative brick “fins” (vertical), and more
- modifications, including interior remodeling, addition of stand-alone sheds, construction of full additions in the rear

heating

- gas-fired boilers, with hydronic (hot water) distribution
- “combi” domestic hot water and space heating
- typically located in the attic

RETROFIT OVERVIEW



- insulated façade (walls) and roof, over existing
- new “combi” air-to-water heat pump
- balanced heat recovery ventilation system
- solar photovoltaic (PV) system
- exterior mechanical room

STEP-BY-STEP RENOVATION
Technical Description

Prefabrication Steps

Measure buildings (3D)

Pre-fabricate wall and roof

Pre-fabricate mech room

STEP-BY-STEP RENOVATION
Technical Description

First steps on site

Remove exterior wall elements: downspouts, house numbers, wall-mounted lighting, etc.

Trench around the building and insulate sub-surface

STEP-BY-STEP RENOVATION
Technical Description

Install wall sections

Remove windows and doors.

Mount structural fasteners on existin walls.

Install pre-fabricated walls.

Seal between wall panels.

Install new windows, doors and window/door extensions.

Seal seams between sections.

STEP-BY-STEP RENOVATION
Technical Description

Roof work

Remove exterior roof elements: chimneys, roof tiles.

Install roof sections.

Install solar modules on the roof.

STEP-BY-STEP RENOVATION
Technical Description

Indoor work

Remove gas meter

Insulate crawlspace with expanded polystyrene chips

Route ventilation ductwork indoors

Kitchen/bathroom: floor/wall/fixtures

Change to electric induction stove

MEDIUM RISE

Visited one four-story site

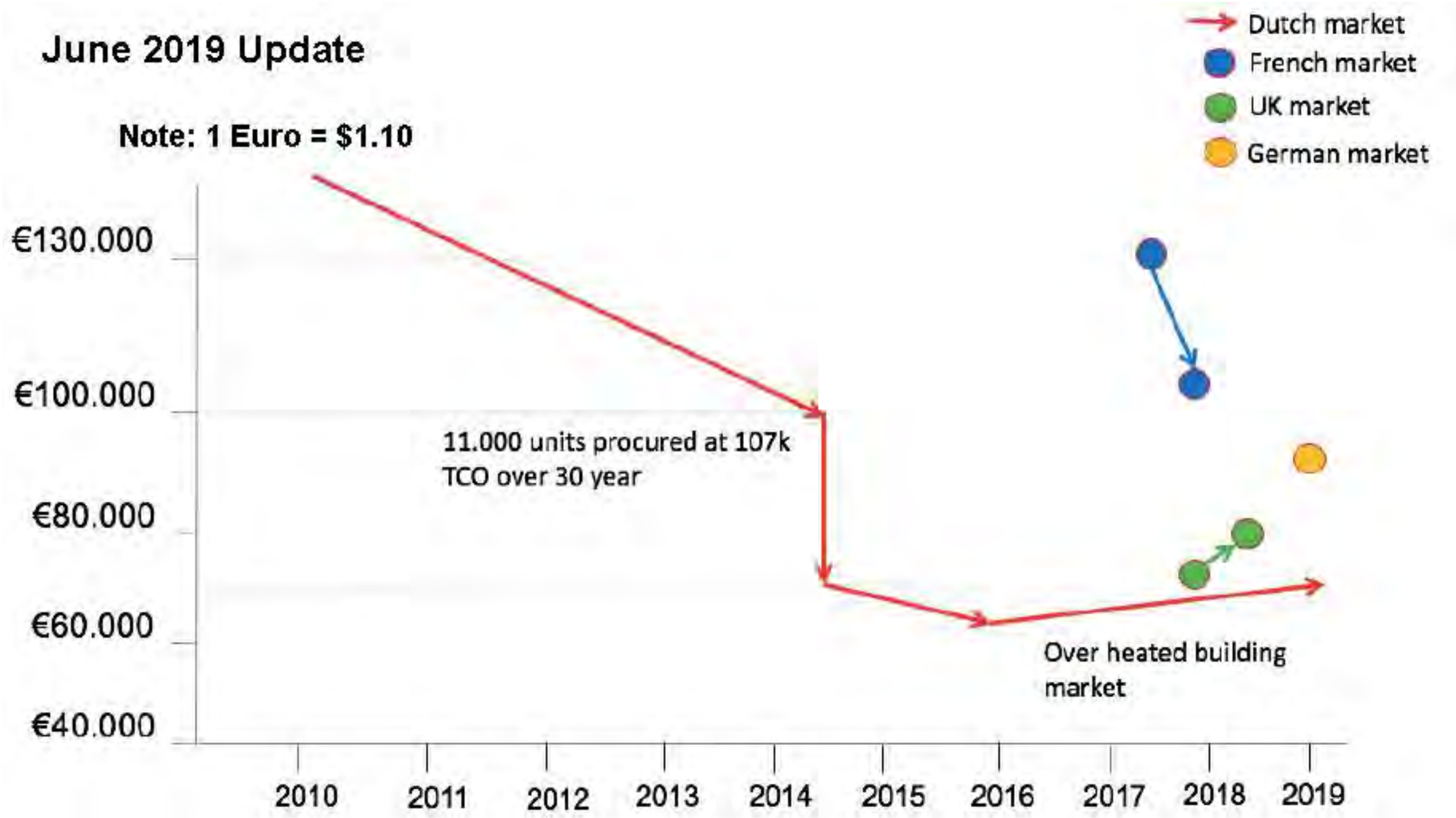
Approach similar to two-story:

- Roof and wall retrofit
- Individual heat pumps
- Exterior mechanical rooms
- Heat recovery ventilation

Results - 49 homes

Predicted average energy use per home:
5906 kwh/year
Measured average energy use per home:
5465 kwh/year
Heat pump: 2533 kwh/year
Appliances: 2538 kwh/year

Generated solar power:
Predicted: 5984 kwh/year


June 2019 Update
Note: 1 Euro = $1.10
Dutch market
French market
UK market
German market
€130.000
€100.000
€80.000
€60.000
€40.000
11.000 units procured at 107k
TCO over 30 year
Over heated building
market
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019

Energy Prices in the Netherlands

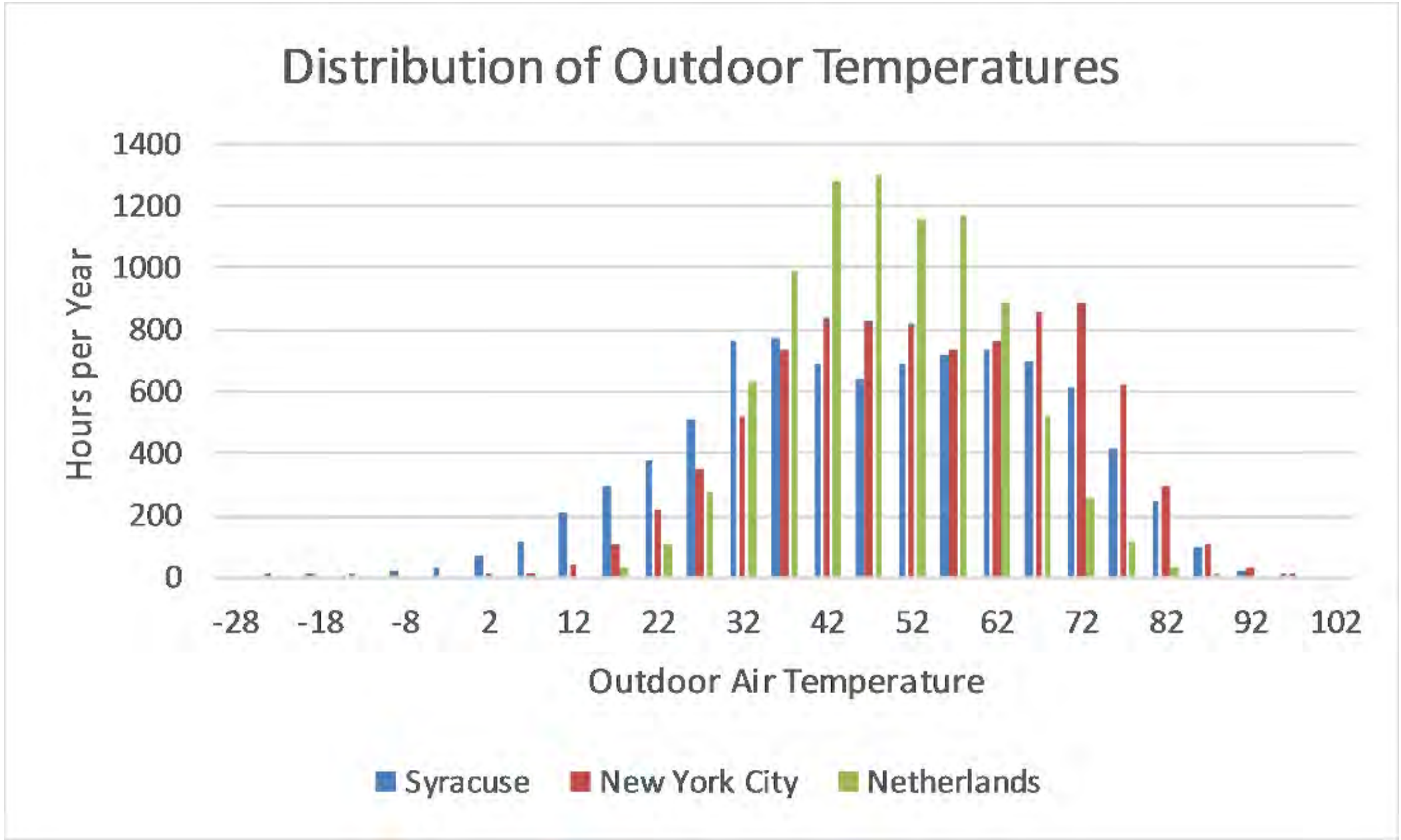
Electricity: $0.17-$0.23/kWh

Natural gas: Over $2/therm

Conclusion: Electricity similar to NYC, higher than upstate.

Gas is two to three times as expensive as in NY State.

Transferability



Transferability

- Netherlands is 5000-6000 heating degree days (HDD).
- NYC is 4500-5000 HDD.
- Upstate NY is 6000-7000 HDD.

Conclusion:

Climate is roughly similar; heating-dominated, but less extreme.

Report Card

Energy conservation	A+	Net zero has been delivered in at least one complex, and possibly more. The approach is robust and should reliably deliver significant energy savings.
Aesthetics	A-	Clean new façade is a positive. Loss of old façade is a negative in some cases. See Photo: Woomward - BAM - 7-1-2016\IMG_2758
Heating	A+	Re-use of existing distribution is a plus – reduces cost and minimizes work in apartments. Conversion to electric heat pumps helps the net zero effort.
Ventilation	A+	Balanced heat recovery.
Insulation	A	Innovative. However, does not appear to be significantly more than code requirement.
Air sealing	A	Tight, and tested. However, does not appear to be Passivhaus level.

Report Card

Construction cost	C	Recognized as a challenge. Many extras are being provided (kitchen/toilet/bath renovations, new landscaping in front), and the envelope is intrinsically complex. Also, distribution of the ventilation ductwork is intrinsically complex. Many custom accommodations are required. Also, there are hints that soft costs have not fully been covered, and also that there has been some "loss leader" investment by builders, so actual costs may be higher than seen so far. Despite a large effort to reduce cost, which is ongoing, the challenge to do so significantly is high.
Tenant satisfaction	B+	Appears generally good. Some noise issues (though not in all installations, and so likely resolvable). Some timing issues. Some changes to scope reportedly bothered tenants. Experience is driving this grade higher, and this should become an A soon.
Benefits to tenants	A+	New clean façade, new windows and doors, kitchen and toilet/bathroom renovations in some cases.
Noise control	B	See Tenant Satisfaction, above.

Report Card

Education and behavior	A	Tenant focus is excellent. One-on-one work with stakeholders appears excellent. Not 100% sure of higher-level development and dissemination of best practices. Constant focus on moving on to "the next big thing" might be reducing focus on best practice development.
Market transformation	A	Outstanding market transformation for large builders and the specific sector (affordable housing).
Spillover	B	There are discussions of the concept being adopted in the UK, France, and the US. Early work is being done on other building sectors. At least one builder is already applying the techniques to new construction.
Stromversnelli ng	A+	Remarkable achievements, moving a well-defined concept well beyond prototype phase.

Report Card

Expected persistence of energy savings	A+	Long-term guarantee is excellent.
Durability	A	May become an A+. Façade durability still to be determined. Also, new sheet metal enclosures for mechanicals need to be proven to stand up to weather (long-term) and to weight of components.
Maintenance / serviceability	A	Exterior mechanicals make for excellent access. Drive to miniaturization may compromise serviceability, otherwise this would be an A+.
Holistic	A	Envelope (insulation, windows, doors, air-sealing), heating, hot water, and ventilation are excellent. This would be an A+ if lights and appliances were included.

Update from Jasper van den Munckhof (Founder) at Energiesprong…

Hi Ian – how’s life?

Happy to give you an update over the phone. Technology wise not much has changed. It has all become a bit more mature.

- Dutch market: 5000 net zero homes per year 50/50 new build and retrofits
- UK market: Around 250 homes with a pretty hard funnel of 1000 homes
- French market around 180 homes with a softer funnel of 14000 homes
- German market: 40 homes and has a pretty hard funnel of 12000 homes

- In NY, RetrofitNY (6 pilot buildings)
- NYCHA is getting a project to market with decent funding
- SUNY tried to procure one campus which came out high.
- California is looking at their first pilots.
- I have had signs of interest from many states in the northeast and northwest.

I have had signs of interest from many states in the northeast and northwest. In Europe we see the building supplies industry stepping in and we see a lot of actors trying to find a spot in the marketplace.

Cheers, **Jasper van den Munckhof**

More information:

https://www.taitem.com/wp-content/uploads/Energiesprong.pdf

THANK YOU

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- Portville Square Apartments
- RetrofitNY

- Margo Valdes
- Senior Project Manager
- Sustainable Comfort Inc.

Existing Conditions

SWBR

SUSTAINABLE COMFORT

conifer®

REAL ESTATE DEVELOPMENT, CONSTRUCTION & MANAGEMENT

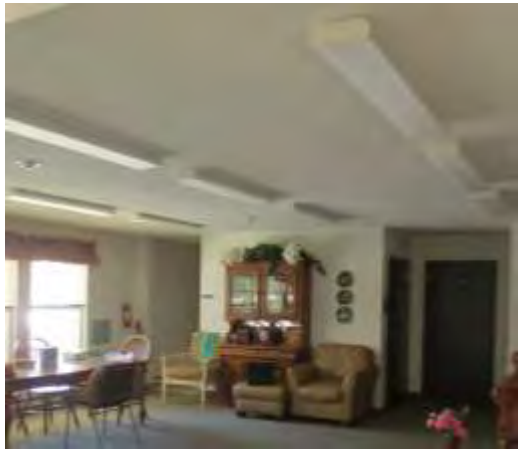
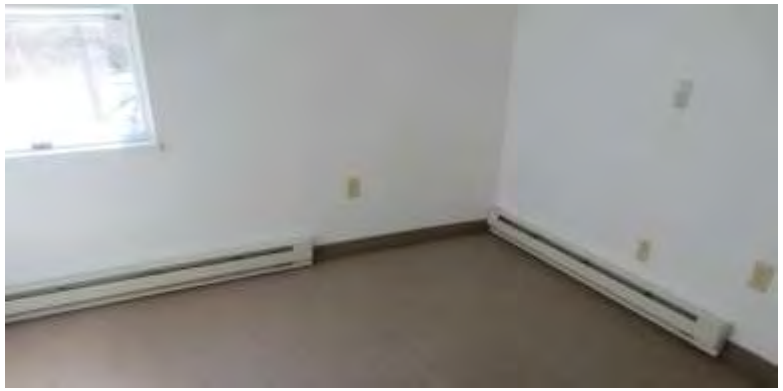
Conifer LeChase CONSTRUCTION

TURNER ENGINEERING, PC

Owner and NYSERDA Goals

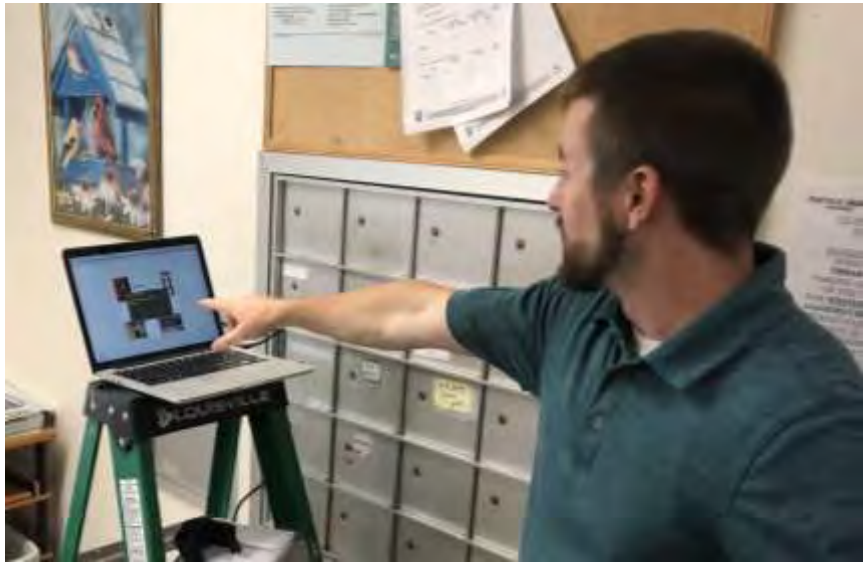
- Scalability
- Meeting program requirements
- Known technologies with reliable manufacturer support

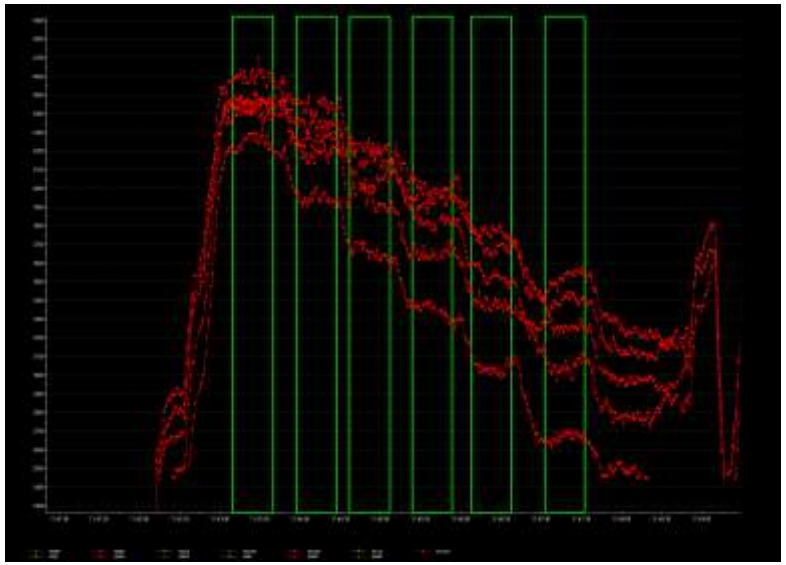


- Baseline EUI 46.7 kbtu/sf/year

Blower Door Testing





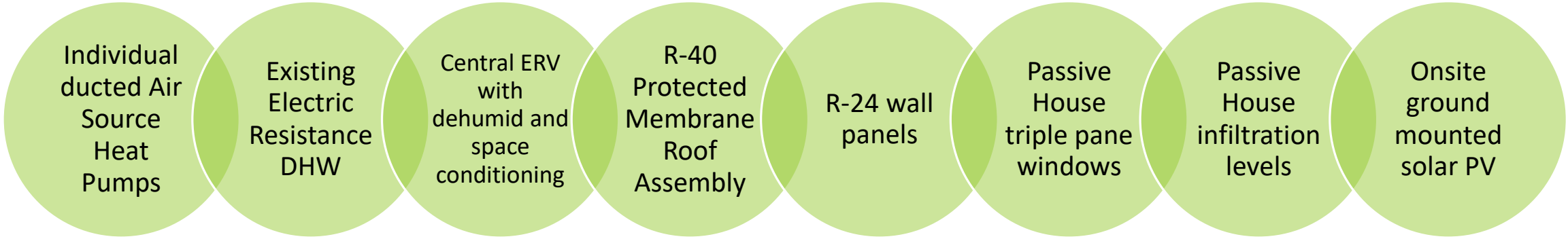
- Result: 6.7ACH50, 0.68 cfm50/sfs

Pull Planning

	Model Input	Baseline	Option 2	Option 3	Option 4	Option 5	Option 6	Option 7	Option 8	Option 9
1	Heating/Cooling	VRF	VRF	VRF	VRF	VRF	VRF	VRF	GSHP	GSHP
2	DHW	Electric Resistance Tank	Electric Resistance Tank	Electric Resistance Tank	Electric Resistance Tank	Electric Resistance Tank	Electric Resistance Tank	On Demand Electric	Electric Resistance Tank	HP
3	Roof R value	60	60	60	60	50	40	60	60	60
4	Wall R value	40	40	40	40	30	50	40	40	40
5	Slab on grade perimeter insulation	20	20	20	20	0	20	20	20	20
6	Window u value	0 35	0 35	0 35	0 2	0 35	0 35	0 35	0 35	0 35
7	Window shgc	0 4	0 4	0 4	0 5	0 4	0 4	0 4	0 4	0 4
8	Door R-value	6	6	6	6	6	6	6	6	6
9	Glass door u value	0 35	0 35	0 35	0 35	0 35	0 35	0 35	0 35	0 35
10	Infiltration cfm/sfs	0 05	0 05	0 2	0 05	0 05	0 05	0 05	0 05	0 05
11	Ventilation effectiveness	70/	85/	70/	70/	70/	70/	70/	70/	70/
12	Ventilation CFM	1080	1080	1080	1080	1080	1080	1080	1080	1080
13	Heating efficiency	3 1	3 1	3 1	3 1	3 1	3 1	3 1	3 5	3 5
14	Cooling COP	4 5	4 5	4 5	4 5	4 5	4 5	4 5	4 4	4 4
15	DHW EF	0 87	0 87	0 87	0 87	0 87	0 87	0 99	0 87	2
16	Site EUI	25 99	25 69	26 34	26 1	26 76	25 83	24 48	25 77	18 69
17	Heating EUI	3 05	2 11	4 5	3 21	5 17	2 58	3 05	3 05	3 05
18	Cooling EUI	2 84	2 84	2 5	3 04	2 84	2 83	2 84	2 84	2 84
19	*Site EUI Reduction*		1/	1/	0/	3/	1/	6/	1/	28/

Figure 1 Preliminary Modeling Iteration Results

Where we ended up



- Final Projected EUI 26.7 ~43% reduction, net zero with the PV

What made Portville Square unique?

- Aerosolized enclosure air sealing

- Panelized wall assembly

Challenges & Barriers to implementation

- $600,000 over budget, gap funding not obtained
- Solar metering
- Availability of efficient electric water heating technology

- Thank you!

- Margo Valdes
- Senior Project Manager
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SUSTAINABLE COMFORT