



# Zero Energy Now

## Vermont's Existing Homes Solution

Chuck Reiss      Reiss Building & Renovation

Richard Faesy    Energy Futures Group

Tom Perry        New Leaf Design

Russ Flanigan    Building Energy

Li Ling Young    Efficiency Vermont



# Synergy

The Whole Can Be Greater  
than the Sum of the Parts

Chuck Reiss

# Looking at a house as a complete System

- What do we have?
  - Measurements
  - Baseline
- Model what is necessary to achieve 90 – 100% renewable energy
  - Finding the sweet spot
- Install the components
- Measure results

# Typical Components of Zero Energy Now Building

- Analysis/ Evaluation/ Modeling
- Weatherize: air seal, insulate
- Add electric/wood heat and hot water
- Renewable energy (solar pv, biomass)
- Battery storage
- Train homeowner





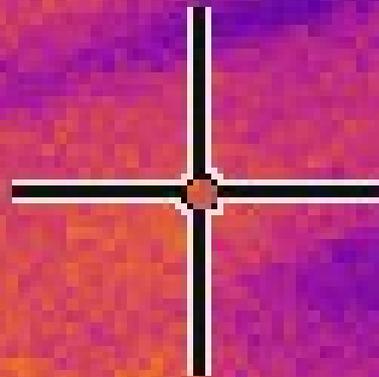
Spot

15.3

°C

 FLIR

17



13















# Zero Energy Now Pilot 2016-2017

Richard Faesy



# The Genesis of Zero Energy Now

- Building Performance Professionals Association of Vermont (BPPA-VT)
  - Contractors, Builders, Energy Consultants, Weatherization Companies, Plumbing and Heating Contractors, Efficiency Vermont
- Retreat in 2015
- “The whole is greater than the sum of the parts”
- Pilot in 2016-2017 with the help of GMP CEED funding

# 2016-2017 Pilot Program



- Comprehensive, streamlined home energy efficiency *and* renewables program
- Minimum program standards
  - Use 10% less energy
  - 50% reduction in fossil fuel use
  - 50% renewable energy
- One touch: one certified contractor guiding the process
- Utilized available incentives, leveraged Federal solar tax credit, tapped into available financing and offered bonus incentive up to \$5000
- Energy savings guarantee

# Why?

## Customer confusion



# Benefits

- For the customer:
  - Streamlined, coordinated, objective offering
  - Move off of fossil fuels
  - Secure your energy costs into the future
  - Realize all available rebates
  - Guaranteed Energy Savings and Quality Service
- For participating contractors:
  - Comprehensive energy solution
  - Not “either” efficiency “or” renewables but “and/both”
  - Larger projects lead to greater savings and more profits
- For utilities:
  - Deeper total energy savings
  - Offer a solution to move customers off of fossil fuels

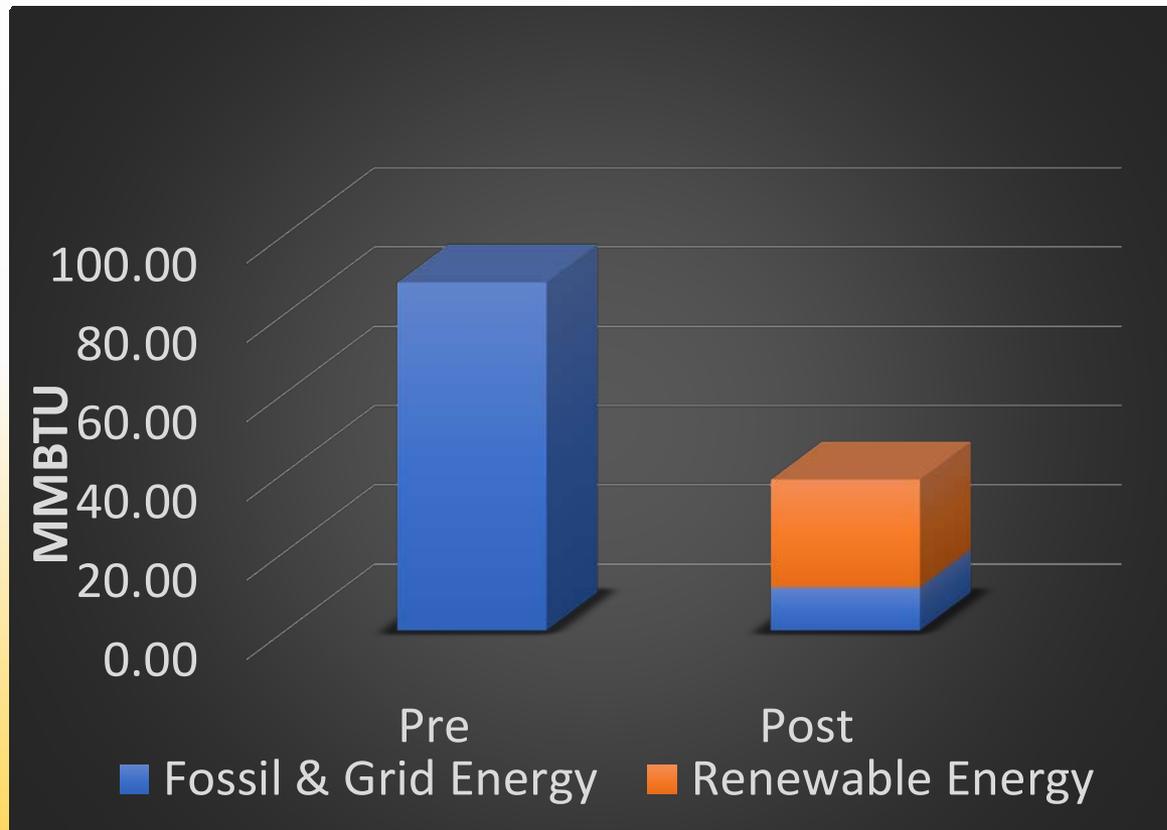


# Zero Energy Now Program Key Elements

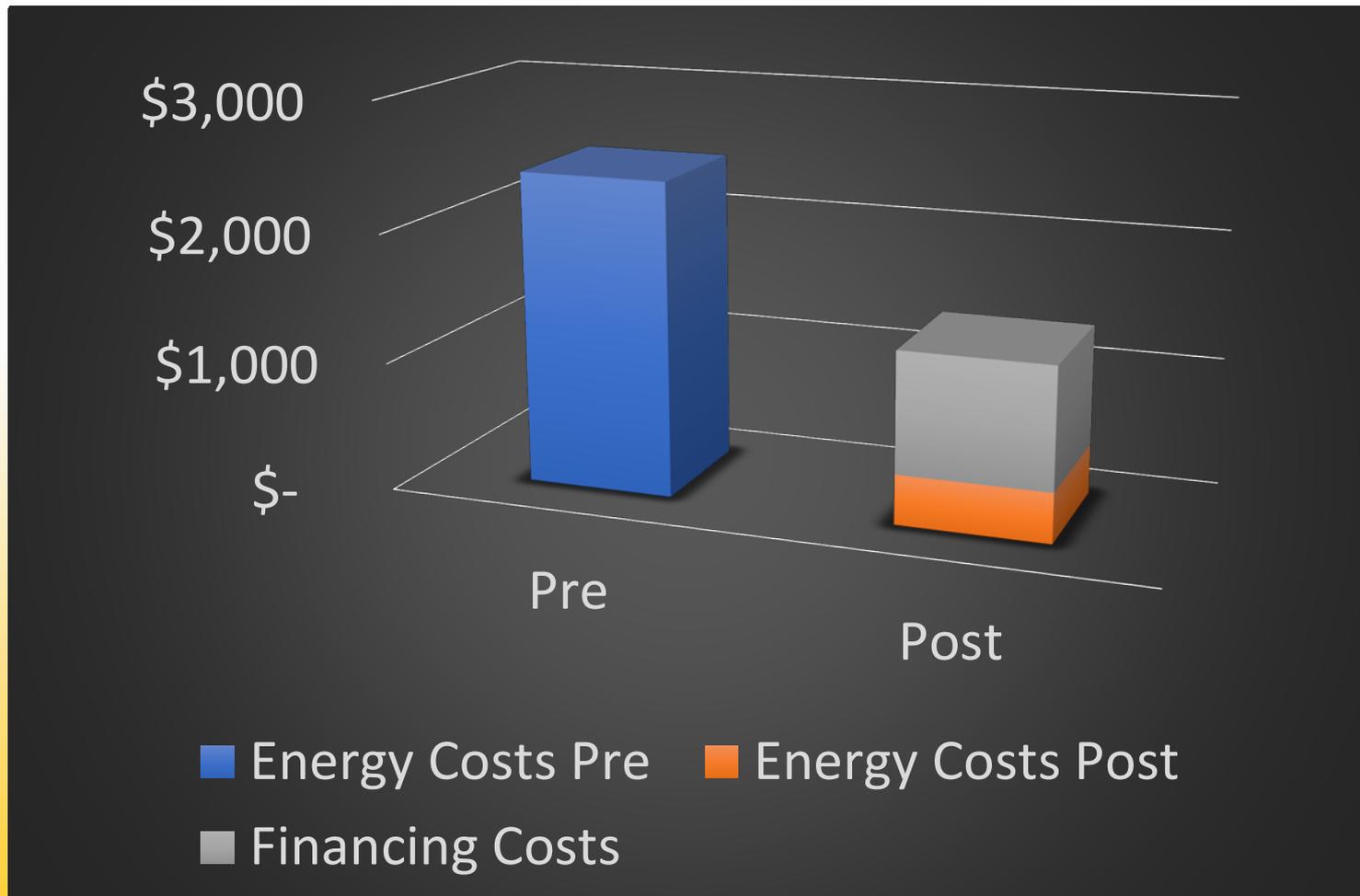


- Building energy modeling
- Custom recommendations
  - Weatherization
  - Heat pumps & wood heating
  - Heat pump water heater
  - Solar PV
  - (Battery storage, demand management controls, EVs, charging stations...)
- Savings Guarantee
- Financing
- ZEN Contractors for turn-key design & delivery
  - Subcontractors
  - Program rebates
  - Customer communication & coordination
  - Reporting
- Program implementation
  - Partnerships
  - Marketing
  - Coordination
  - Management
  - Reporting

# Turn-Key Comprehensive Approach



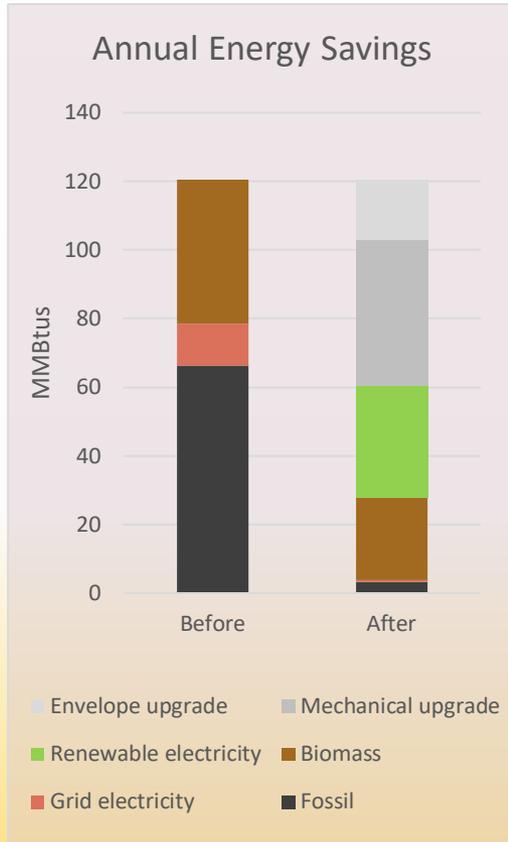
# Affordability



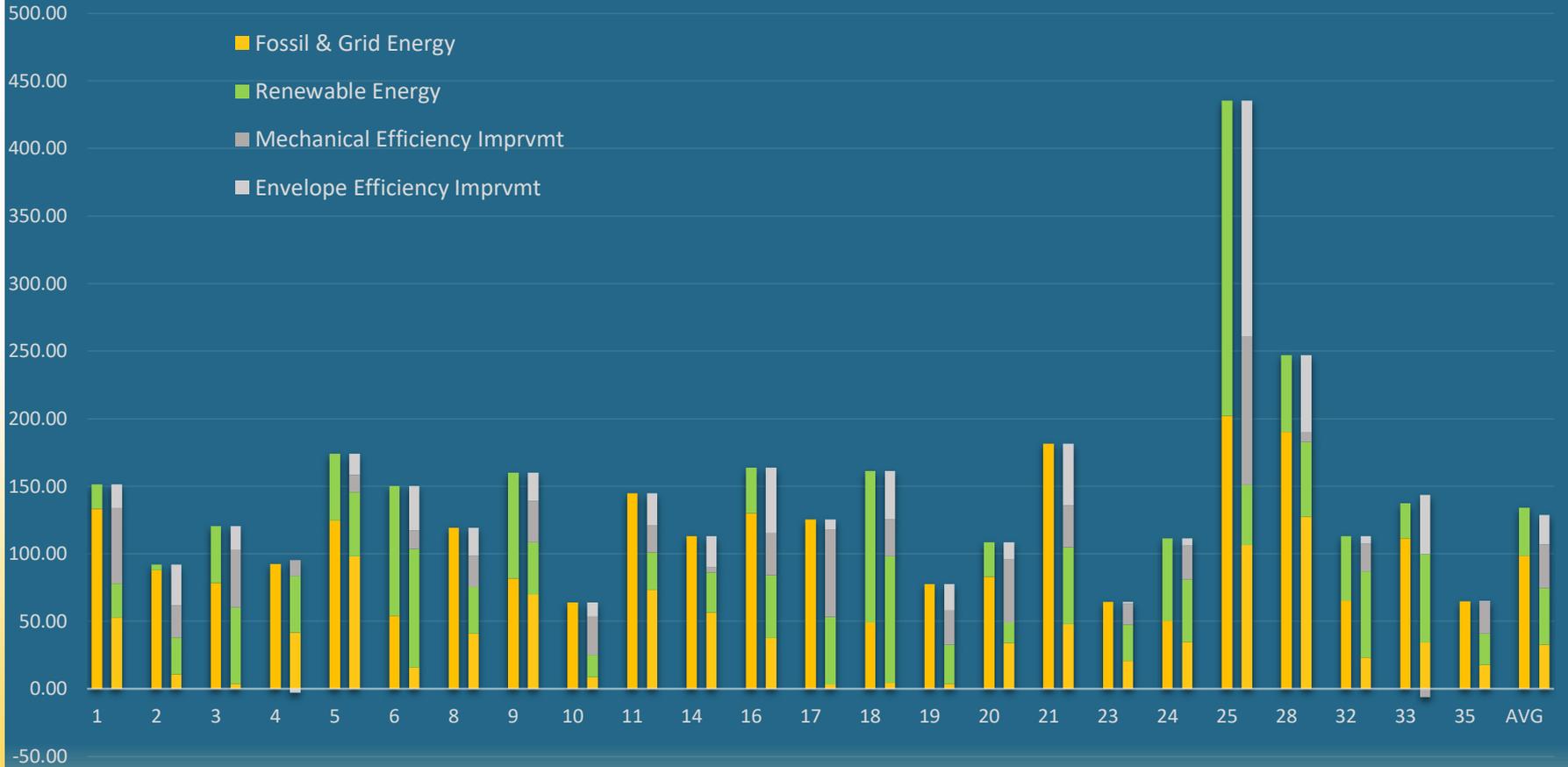
# Zero Energy Now Study

- 35 homes
- 24 evaluated
- Post-improvement
  - Fuel and electricity
- Customer satisfaction

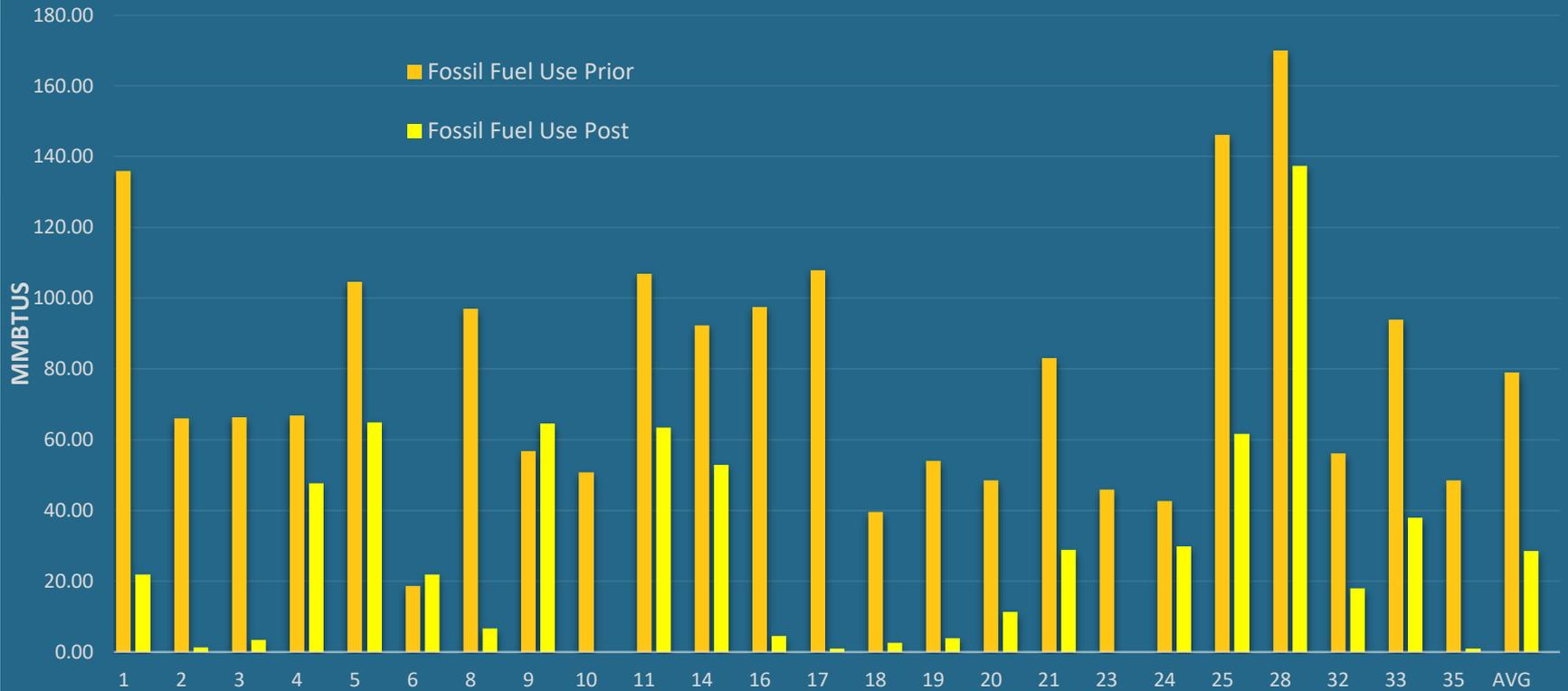




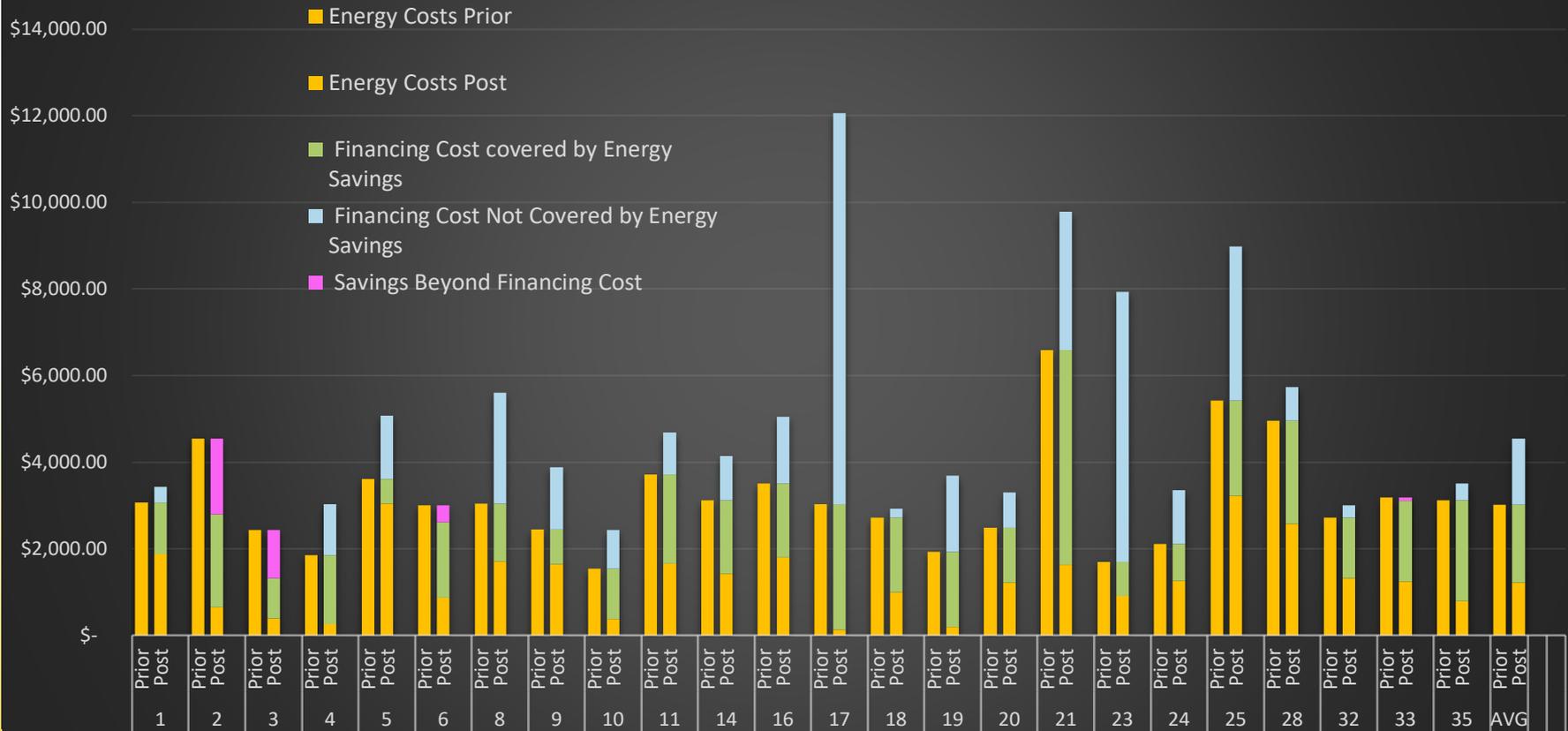
## Energy Savings -- Zero Energy Now



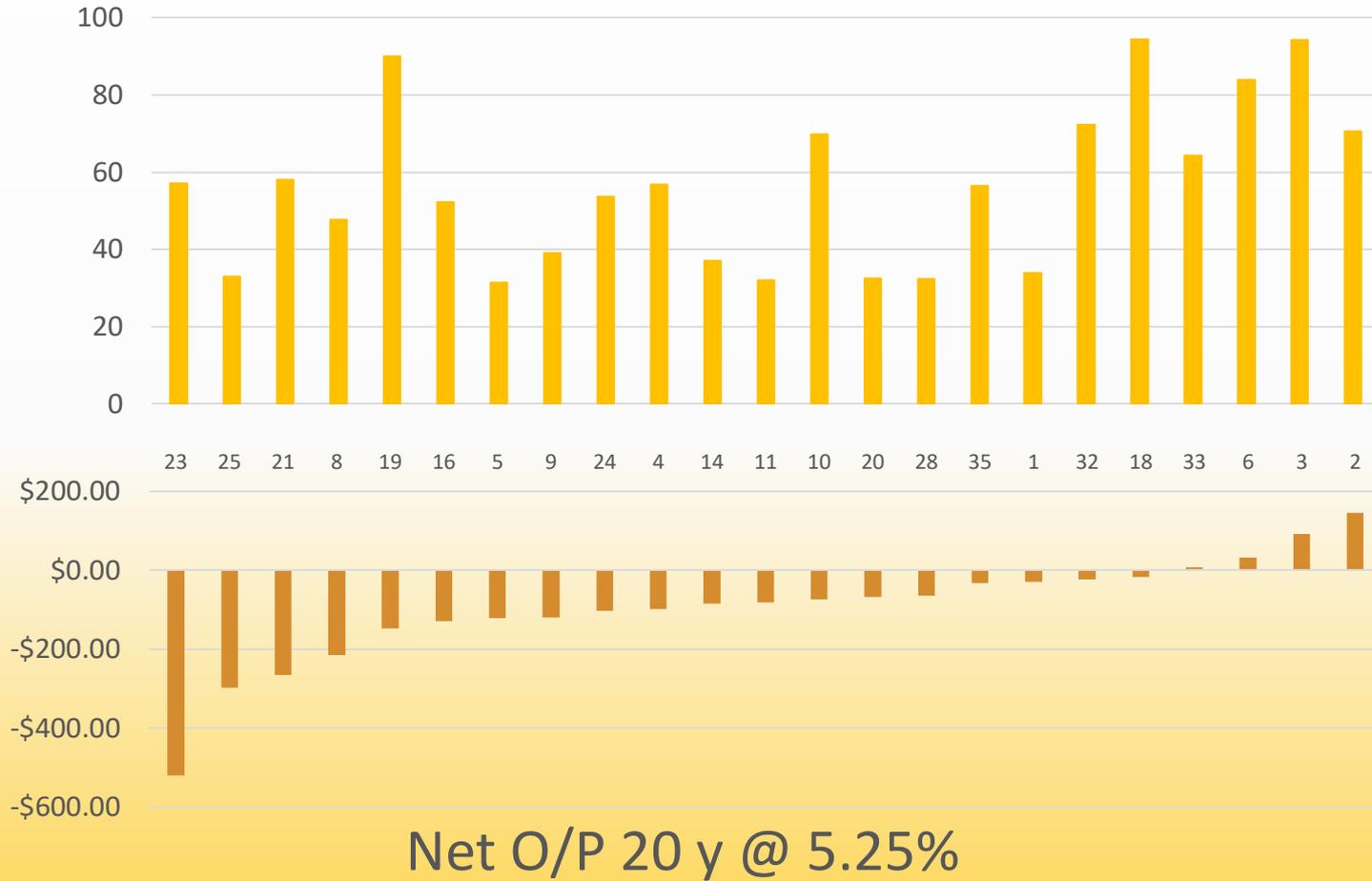
## Fossil Fuel Use -- Before and After Zero Energy Now Project



## Annual Energy Costs and Financeability



# % renewable



# Each year

in just 24 homes...

- 
- A dark silhouette of a mountain range with several peaks, set against a light yellow background.
- Not burned
    - 8,820 gallons fuel oil
    - 3,103 gallons propane
    - 21 cords wood
  - Generated
    - 201,468 kWh electricity
  - Saved
    - \$44,670 in energy costs
    - 114 metric tons CO2

# Customer Feedback

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- Satisfaction
- Savings
- Starting point
- Heat pump operation
- Project integration
- Zero energy journey

# Customer Feedback

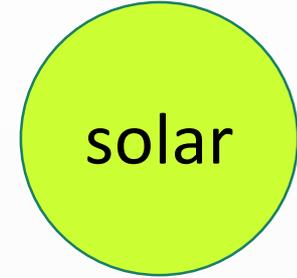
- Satisfaction

A blue circle with a thin black outline containing the text "Part of the solution" in white.

Part of  
the  
solution

A red circle with a thin black outline containing the text "comfort" in white.

comfort

A yellow-green circle with a thin black outline containing the text "solar" in black.

solar

A grey circle with a thin black outline containing the text "No fossil fuels" in white.

No  
fossil  
fuels

# Customer Feedback

- Savings

Not a big deal?!

“Less important than cash flow.”

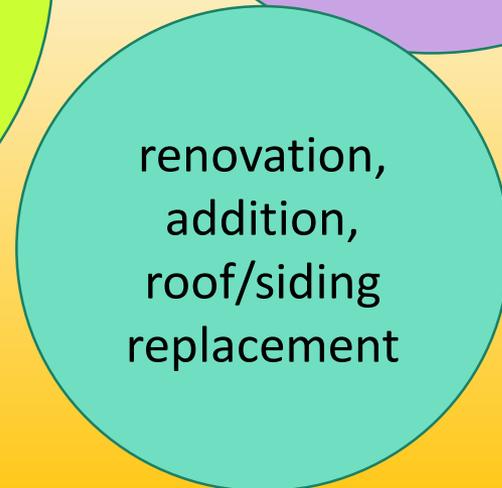
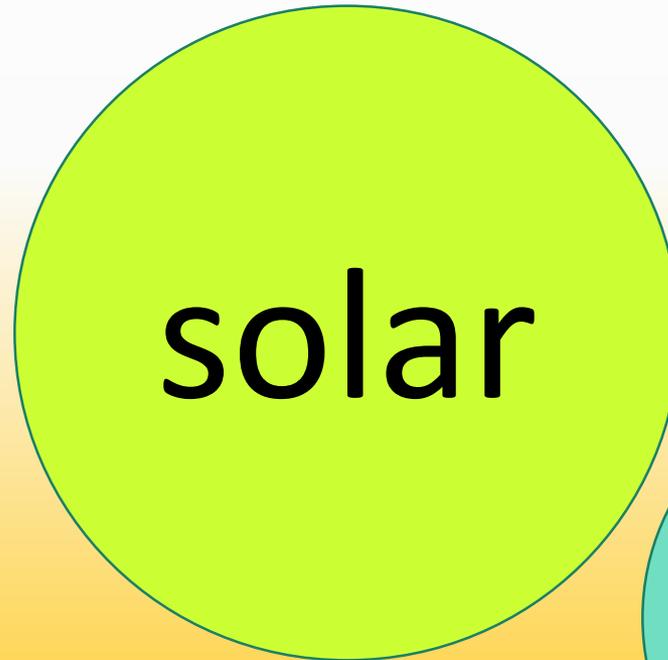
“Looking to long term benefits.”

“Different prioritization.”

“We didn’t do this for the energy cost savings.”

# Customer Feedback

- Starting point



# Customer Feedback

- Heat pump operation

Homeowners were given no guidance on how to operate their heat pumps.

# Customer Feedback

- Project integration

Project Management  
made highly satisfied  
customers.

# Customer Feedback

- Zero energy journey





# Case Studies

Russ Flanigan

## Ranch, 1336 sq ft

Gross Project Cost: \$56,612

Net Project Cost: \$43,209

- 8 kW solar array
- Heat pump water heater
- Mini-split heat pumps
- Attic and basement insulation and air seal



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	92.35	41.69
Annual Energy Costs	\$1,846	\$258
	<b>Projected</b>	<b>Actual</b>
F&G savings	81%	54%



## Colonial, 1832 sq ft

Gross Project Cost: \$ 37,474

Net Project Cost: \$ 23,925

- 6.4 kW solar array
- Heat pump water heater
- Mini-split heat pumps
- Attic and basement insulation and air seal



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	49.07	4.52
Annual Energy Costs	\$2,718	\$993
	<b>Projected</b>	<b>Actual</b>
F&G savings	75%	98%



## Colonial, 1400 sq ft

Gross Project Cost: \$52,357

Net Project Cost: \$34,254

- 13 kW solar array
- Heat pump water heater
- Mini-split heat pump



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	92.35	41.69
Annual Energy Costs	\$1,846	\$258
	<b>Projected</b>	<b>Actual</b>
F&G savings	81%	54%



## Ranch, 1688 sq ft

Gross Project Cost: \$26,635

Net Project Cost: \$16,143

- 7.8 kW solar array
- Heat pump water heater
- Mini-split heat pump



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	78.57	3.75
Annual Energy Costs	\$2,430	\$387

	<b>Projected</b>	<b>Actual</b>
F&G savings	93%	95%



## Colonial, 2050 sq ft

Gross Project Cost: \$38,892

Net Project Cost: \$25,014

- 6.6 kW solar array
- 2 Mini-split heat pumps
- Major attic insulation



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	124.59	98.31
Annual Energy Costs	\$3,614	\$3,048

	<b>Projected</b>	<b>Actual</b>
F&G savings	81%	21%



## Modern, 4160 sq ft

Gross Project Cost: \$88,712

Net Project Cost: \$71,236

- 16 kW solar array
- Multi-zone heat pump
- Heat pump water heater for slab heat and DHW
- Major attic insulation



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	202.25	106.59
Annual Energy Costs	\$5,418	\$3,220

	<b>Projected</b>	<b>Actual</b>
F&G savings	109%	47%



## Colonial, 2270 sq ft

Gross Project Cost: \$30,011

Net Project Cost: \$20,766

- 5.9 kW solar array
- Mini-split heat pump
- Wood stove upgrade
- Major roof insulation



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	65.24	23.29
Annual Energy Costs	\$2,723	\$1,320

	<b>Projected</b>	<b>Actual</b>
F&G savings	64%	86%



## Farmhouse, 1908 sq ft

Gross Project Cost: \$34,549

Net Project Cost: \$26,499

- 4.6 kW solar array
- Mini-split heat pump
- Pellet stove
- Attic and basement insulation and air seal



	<b>Pre-Project</b>	<b>Post-Project</b>
Fossil & Grid MMBtu	87.89	10.96
Annual Energy Costs	\$4,538	\$653

	<b>Projected</b>	<b>Actual</b>
F&G savings	66%	87%





# Where to Next?

Richard Faesy

# Zero Energy Now 2020

- Builds on experience and lessons learned from pilot efforts:
  - A Turn-Key Comprehensive Approach
  - General Contractor to coordinate projects
  - Deep energy savings while moving off of fossil fuels
  - Guaranteed savings
  - Program partnerships
- *A Program That Links The Existing Homes Market To Vermont's 2050 Goals*

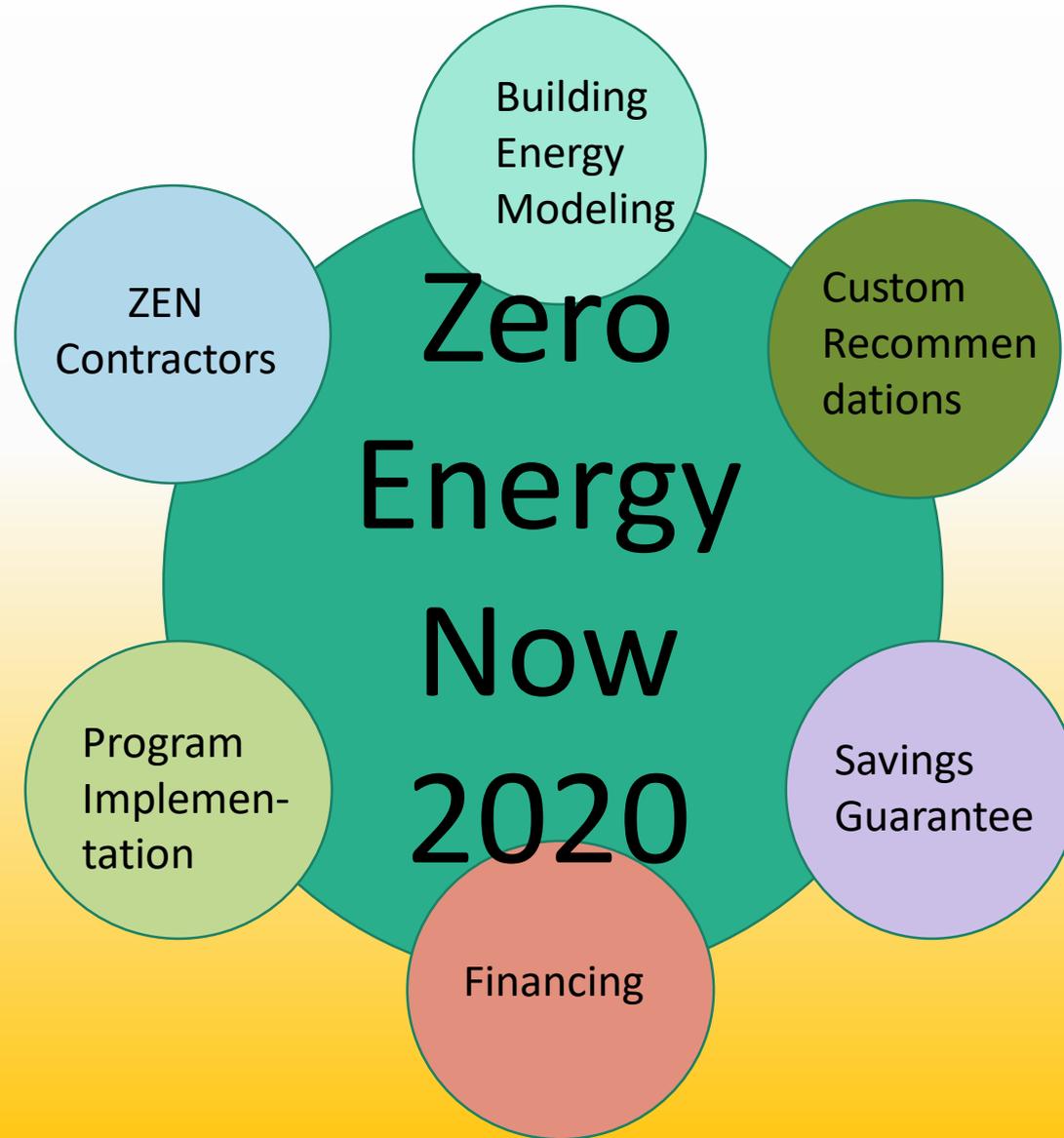
# Recent Developments

- Funding to re-develop Zero Energy Now in Vermont
- Goals:
  - 10 homes in 2020
  - 20 in 2021
  - 75 in 2022
- Grow to other Northeast states after demonstrating success here

# Program Approach

- Development of program elements
- Program standards
- Modeling software
- Financing
- Savings guarantee
- Recruitment and training of contractors
- Marketing
- Partners...

# Key Program Elements



# Partners

- Seeking utility partners to develop comprehensive offer and customer incentives
- Steering Committee
- BPPA
- Efficiency Vermont
- Affordable housing providers
- Lenders
- Others
- Interested contractors

# Next Steps

- Program development
- Contractor selection and training
- Marketing
- Project enrollment
- Funding and partnerships
- Open the doors to customers in Q3 2020

# Interested?

Richard Faesy

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