

*“Promoting and advancing the development of healthy, durable, and sustainable shelter for Alaskans and other Circumpolar People ”*



COLD CLIMATE HOUSING RESEARCH CENTER

**CCHRC**





Cold Climate Housing Research Center

**CCHRC**

# CCHRC Research and Testing Facility



LEED Platinum



# SIEMENS

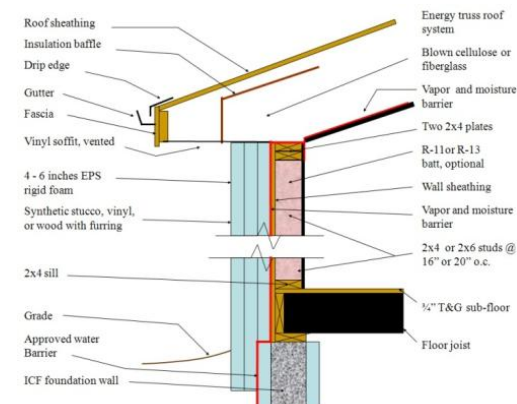
Runner-up  
Smartest Building in America





# Research Programs

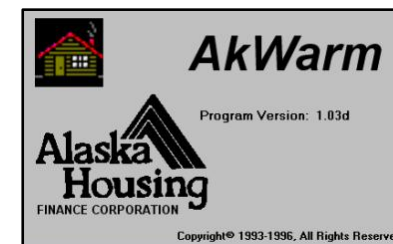
## Building Envelopes & Materials



## Energy & Mechanical Systems



## Policy & Program Development







## Net Zero- Passive House



Alaska is part of the  
Global Arctic Community





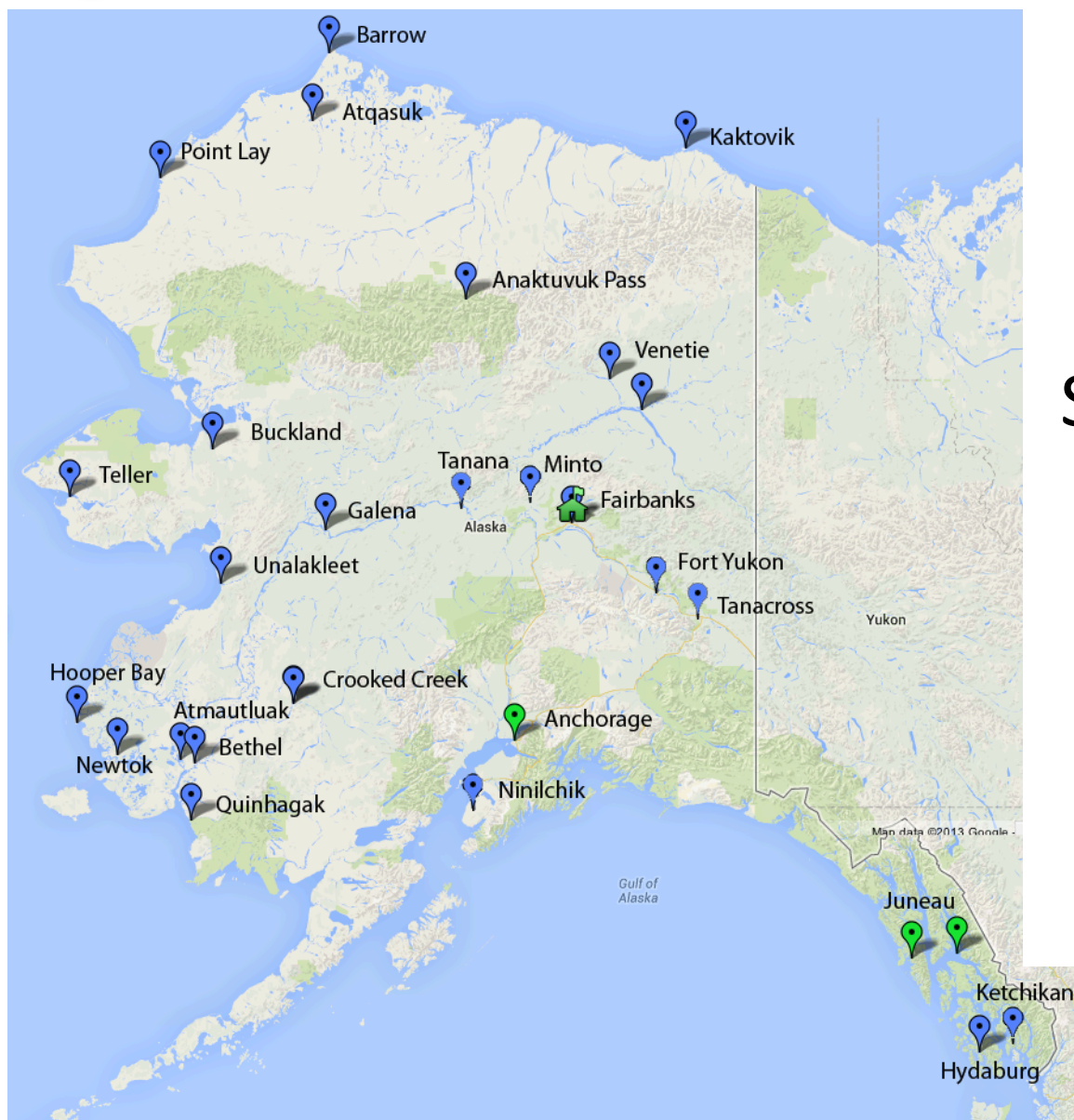
# Indigenous Wisdom for our dilemma in time

## LEARN FROM NATURE

RETAINING heat, not PRODUCING heat, is the most important part of an animal's survival.







# Sustainable Northern Communities

Building Alaska's Future Together





# Sustainable Northern Communities

COLABORATIVE HOUSING DESIGN - Build it right the first time

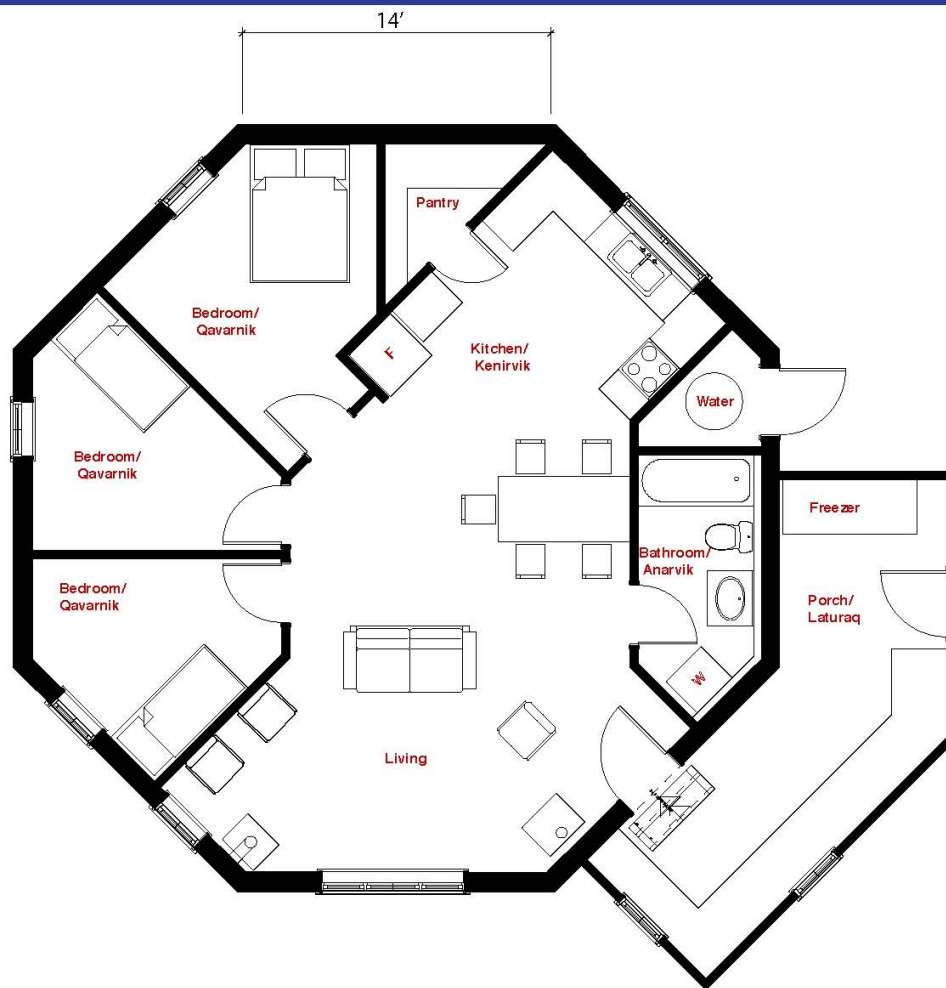






# Quinhagak

## LISTEN!





## Quinhagak House - Performance

- 132 gallons fuel oil first winter
- Superior indoor air
- Built in 6 weeks
- Local labor force
- Light materials
- High owner comfort
- Significantly less cost
- Durable







# Working with what we have....











## A HOLISTIC APPROACH.....Shelter





## Alaskan Efforts

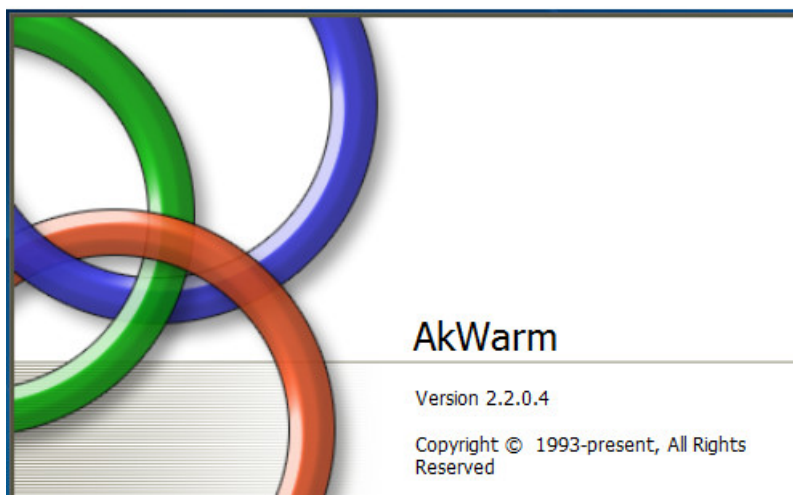
- Home Energy Rebate Program (**GREEN**)
  - Alaska-specific
  - Gives rebates up to \$10k for retrofits
  - Mostly used in urban areas
- Weatherization Program (**PURPLE**)
  - Mostly Alaska Funding (96%) + Federal Weatherization Assistance Program funds
  - Extra funding for remote areas
  - 38% of retrofit homes included Alaska Natives (Native population is ~20% of Alaska population)





## Alaskan Efforts

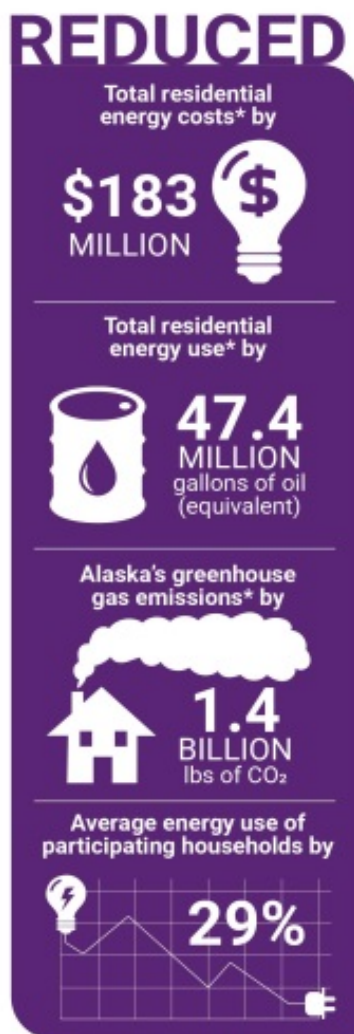
- AkWarm
  - Free software (developed by Alaska Housing Finance Corporation)
  - Easy to use
  - Provides list of most cost effective energy efficiency retrofits



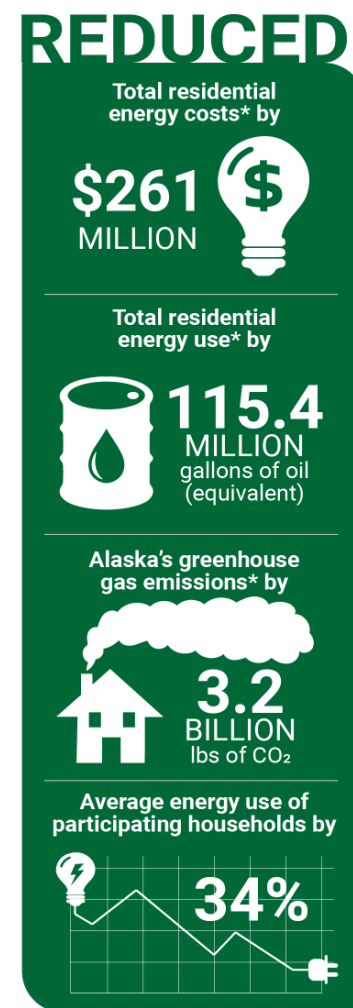


# Alaskan Efforts – Helps Families

- Saves energy
- Saves money
- Improved comfort
- Improves Health



\* These reductions are cumulative estimates for the period of 2008 to 2018.



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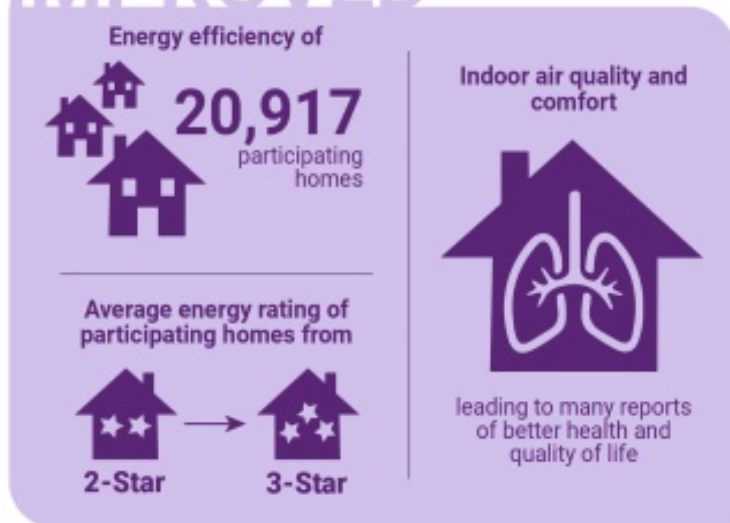


# Alaskan Efforts – Improved Health

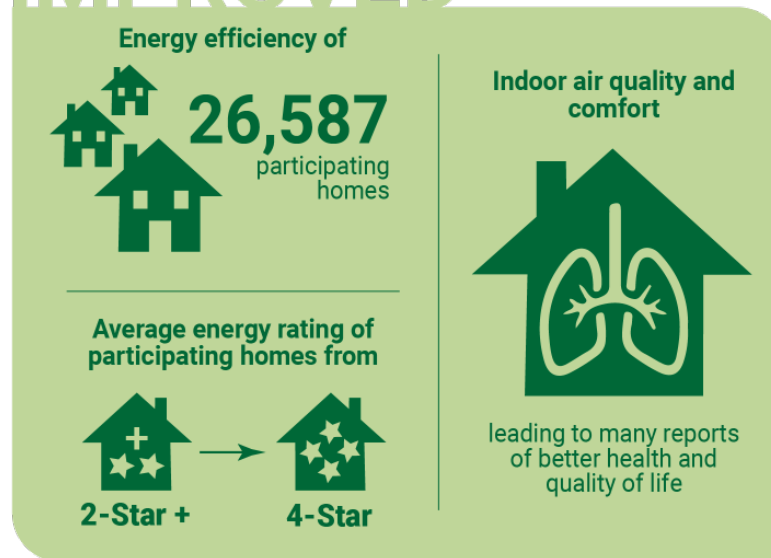
- People spend 65% of their time at home
- Indoor pollutants are harmful to health
- Especially kids and elders:
  - Spend more time at home
  - Developing lungs or compromised immune systems



## IMPROVED



## IMPROVED





# Alaskan Efforts - Retrofits

- Stimulates the economy:
  - Families: save \$ on energy, can spend elsewhere
  - Local contractors: you can't buy a retrofit on Amazon
  - Support services: hardware stores, accountants, etc.
- Creates jobs

## STIMULATED

**\$863.6**  
MILLION



in Direct, Indirect,  
and Induced  
economic impacts

The creation of  
an estimated



**5,460**  
annual jobs

**\$319.9**  
MILLION



in health and safety  
impacts

## STIMULATED

**\$142.2**  
MILLION



in private  
investments for  
home retrofits

The creation of  
an estimated



**6,789**  
annual jobs

**\$912.5**  
MILLION



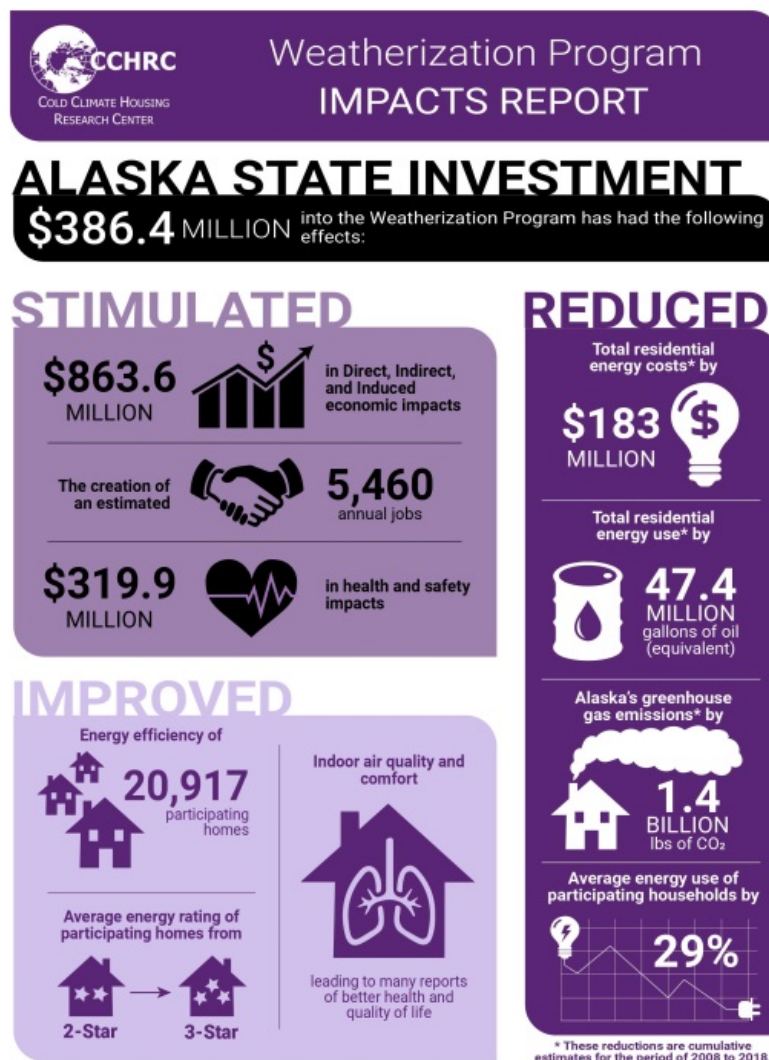
in Direct, Indirect,  
and Induced  
economic impacts





# Alaskan Efforts – Data Sources

- Home Energy Rebate and Weatherization Impacts:
  - <http://cchrc.org/energy-efficiency-programs-impacts-report/>
- 2018 Alaska Housing Assessment
  - <https://www.ahfc.us/efficiency/research-information-center/alaska-housing-assessment/2018-housing-assessment>







# REMOTE wall system

## Residential Exterior Outside-insulation TEchnique



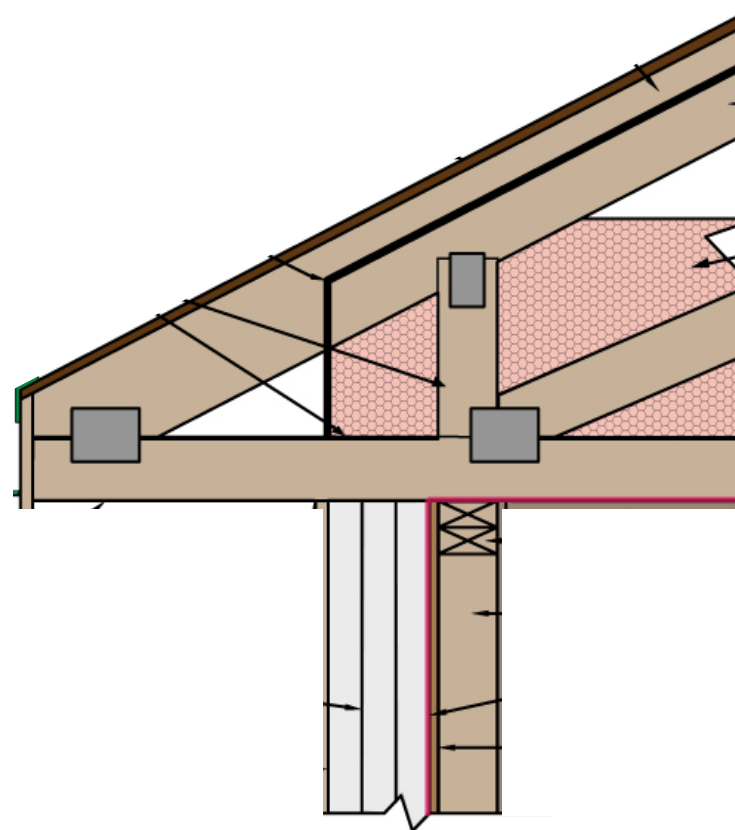




# REMOTE wall system

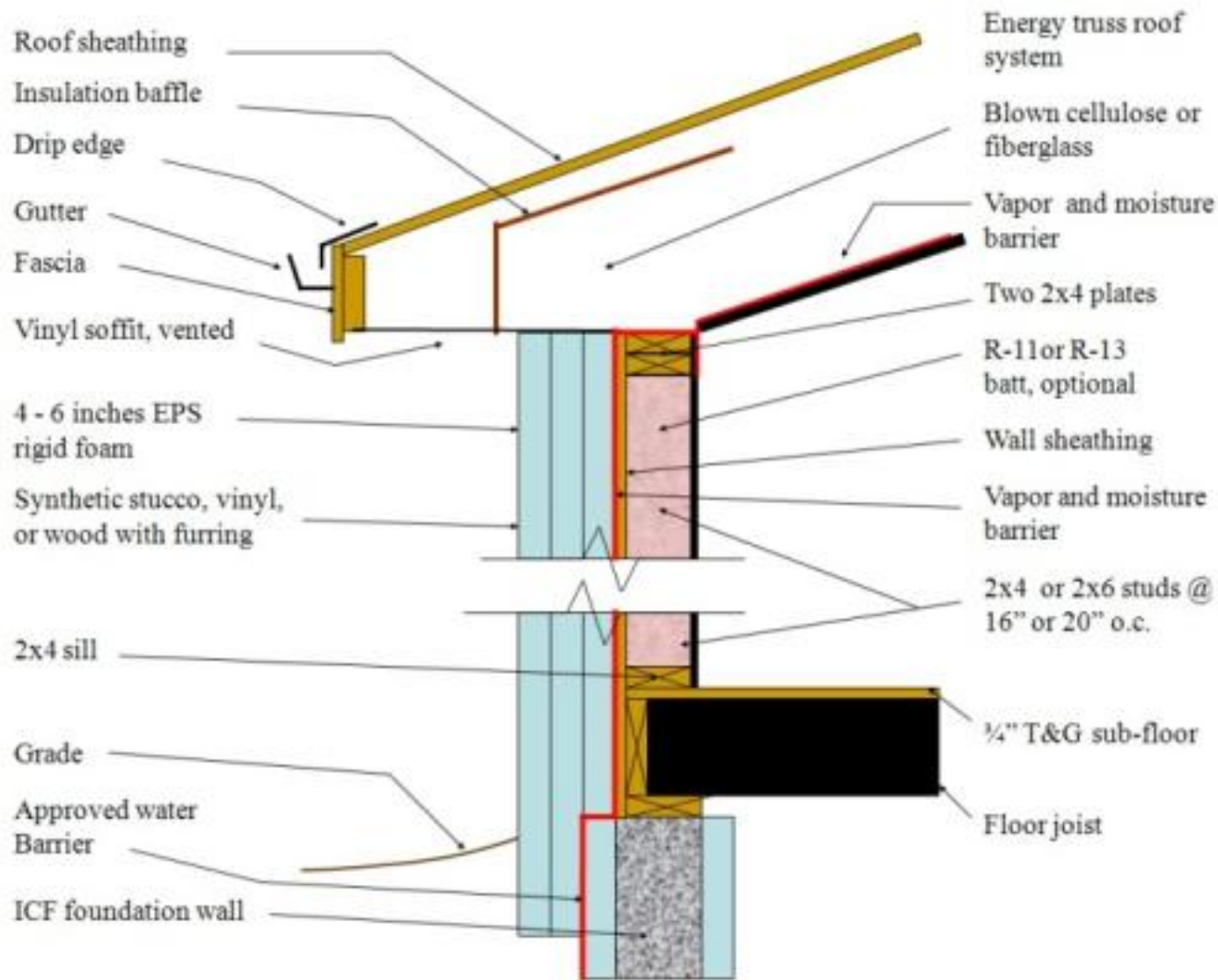
## REMOTE Construction

- Majority of the insulation is external
- Air/vapor barrier is on the wall sheathing
- Allows for a tight and continuous barrier
- R-values of up to 50
- Wall system can dry to the interior
- New and retrofit applications





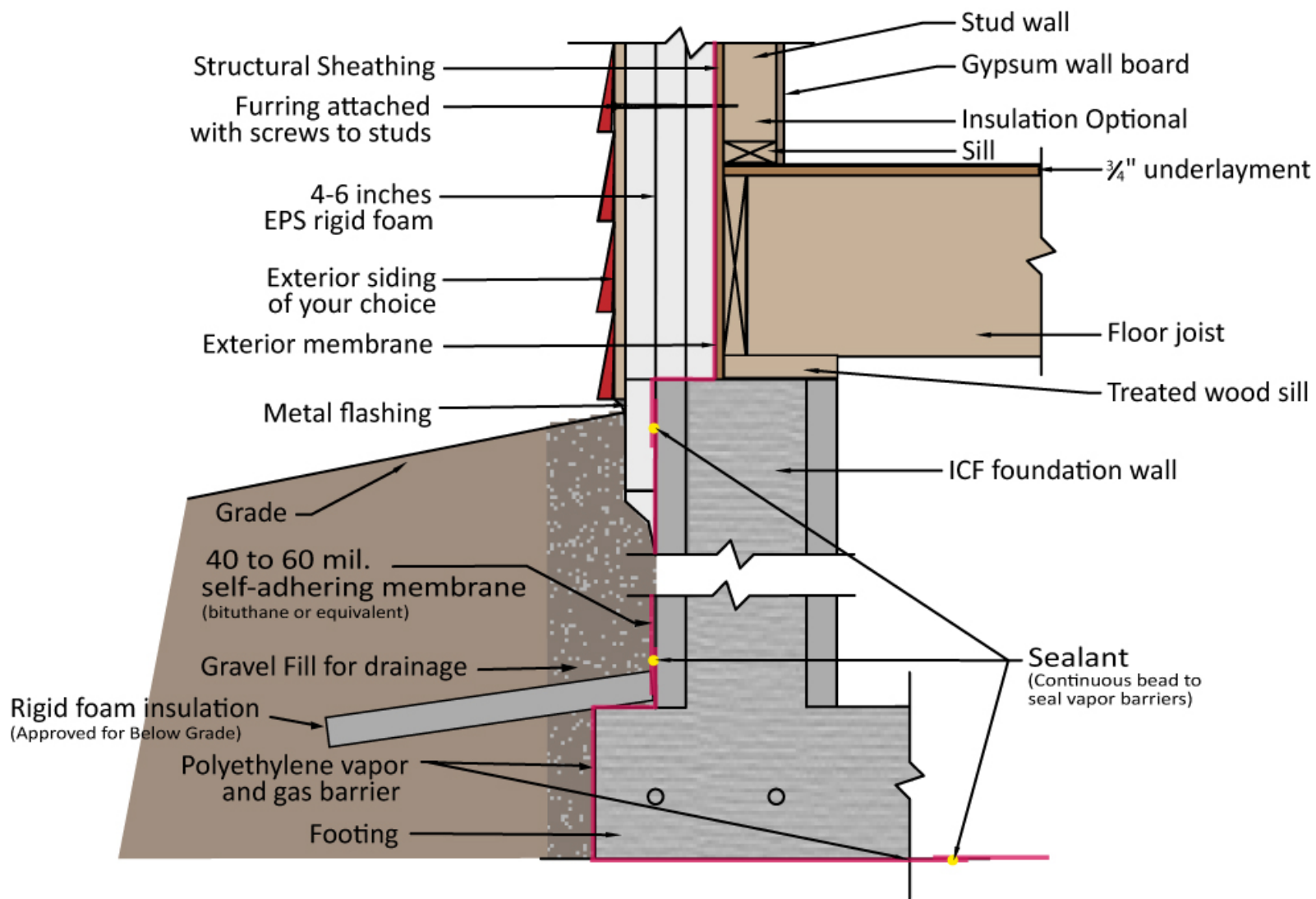
# REMOTE wall system







# REMOTE wall system





# REMOTE in retrofits

## Benefits

- Reduces heat loss
- Reduces condensation potential
- Reduces air leakage

## Considerations

- Homes may already have a vapor barrier
- Changing potential for condensation and drying
- Forces consideration of ventilation







# Exterior insulation retrofits

## Current Questions

- Potential double vapor barrier problems?
- How much exterior insulation?
- Does adequate ventilation = success?



## Mobile Test Lab

- Road worthy trailer
- Nine 4 x 8 wall panels
- 2x4 and 2x6 wall assemblies





# Exterior insulation retrofits

## Mobile Test Lab

- Fiberglass batts in stud cavities
- Varying degree of exterior insulation with EPS and SPF
- With and without interior vapor barriers



## Test Conditions

- 40% relative humidity
- 4 – 8 Pa positive pressurization
- Vapor barrier with unsealed penetrations







## Exterior insulation retrofits - CAUTION

Studies and experience show insulation ratios must be correct, condensation avoided and drainage planes in place for bulk water







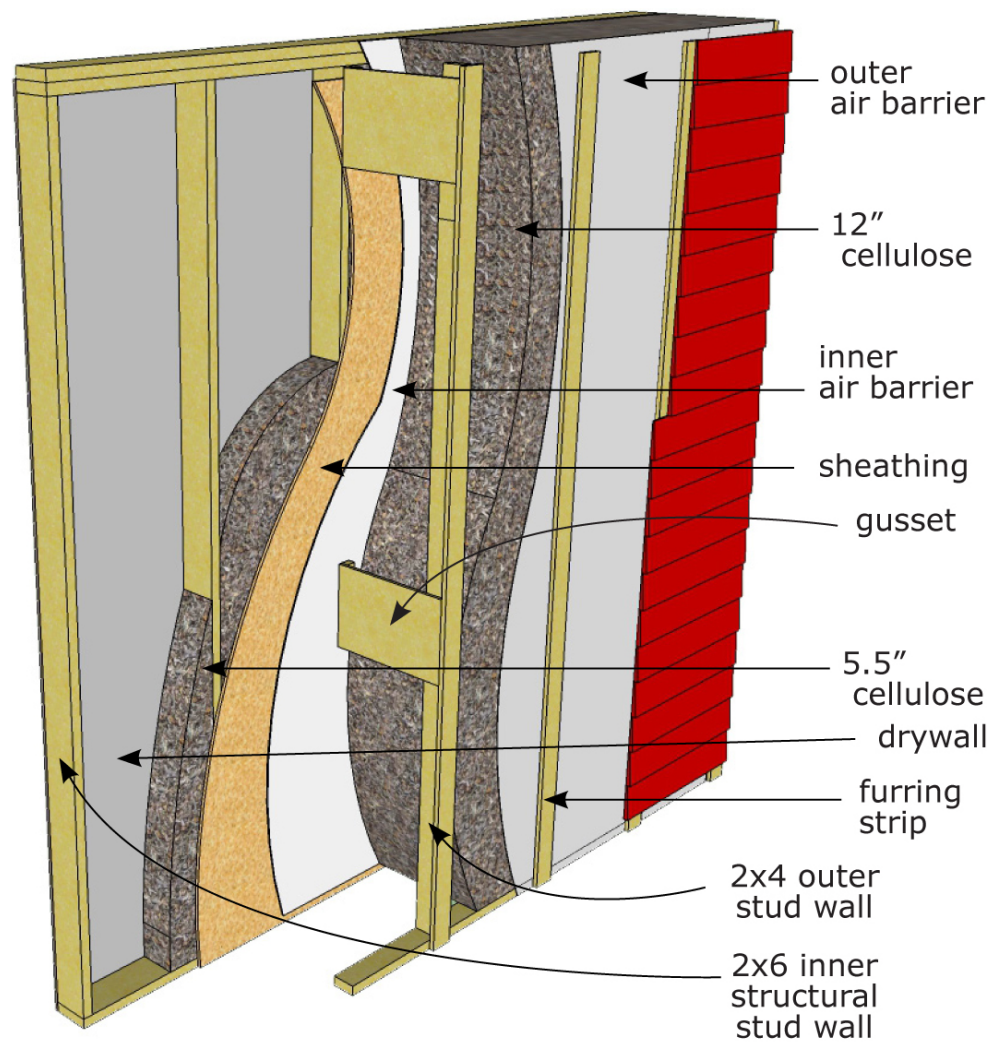
# VIPs and the New Iglu development







# Arctic Wall





# Choices and Paybacks

## Insulation



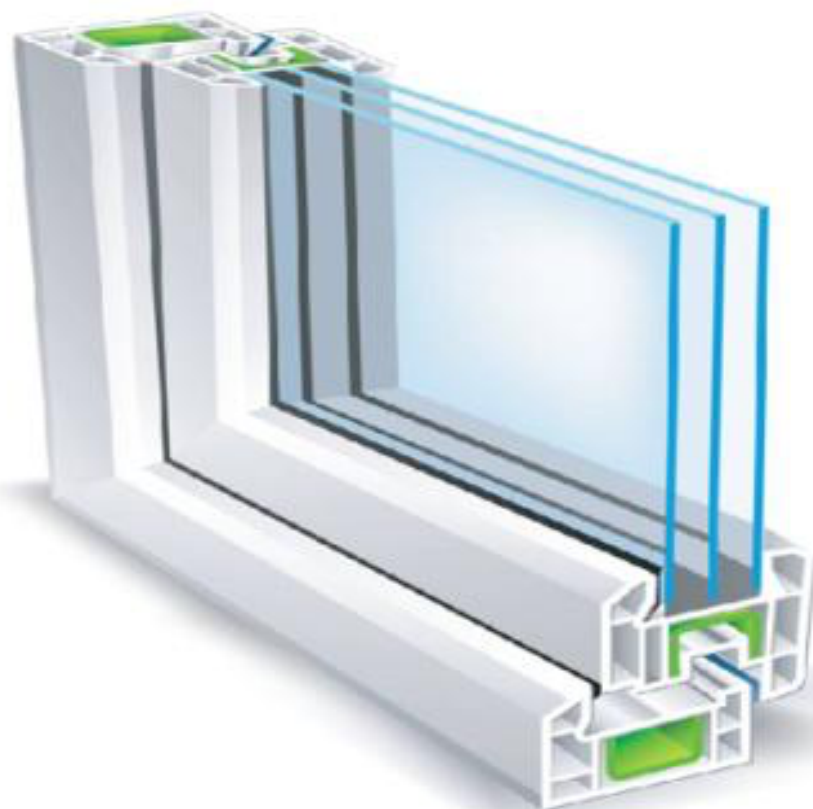
R-Value	Oil (gal/yr)
117	292
76	318
73	321
65	331
51	354
35.7	398
28.2	437
19	617





# Choices and Paybacks

## Triple Pane Windows



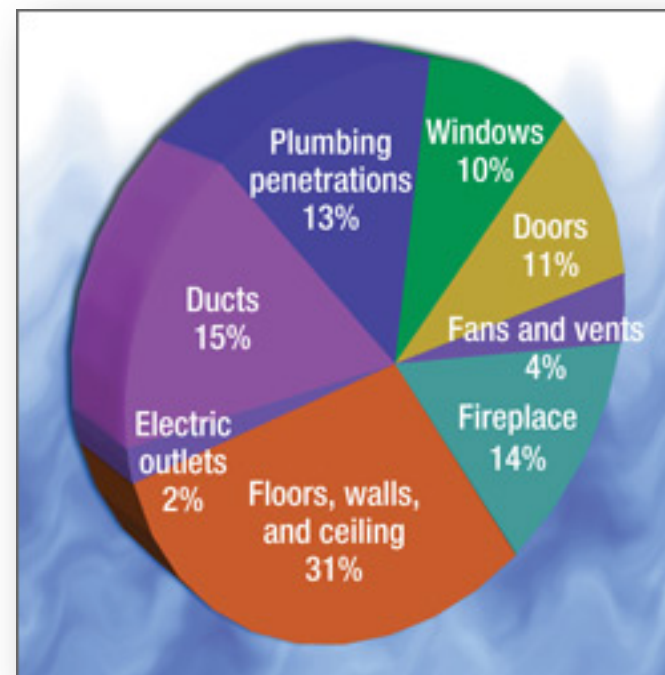
Fuel savings over double pane

77 gallons fuel oil



# Choices and Paybacks

## Air Sealing



5 ACH<sub>50</sub>

2.45 ACH<sub>50</sub>

18 MMBtu/yr savings (138 gallons oil)





# Choices and Paybacks

## Roof Insulation

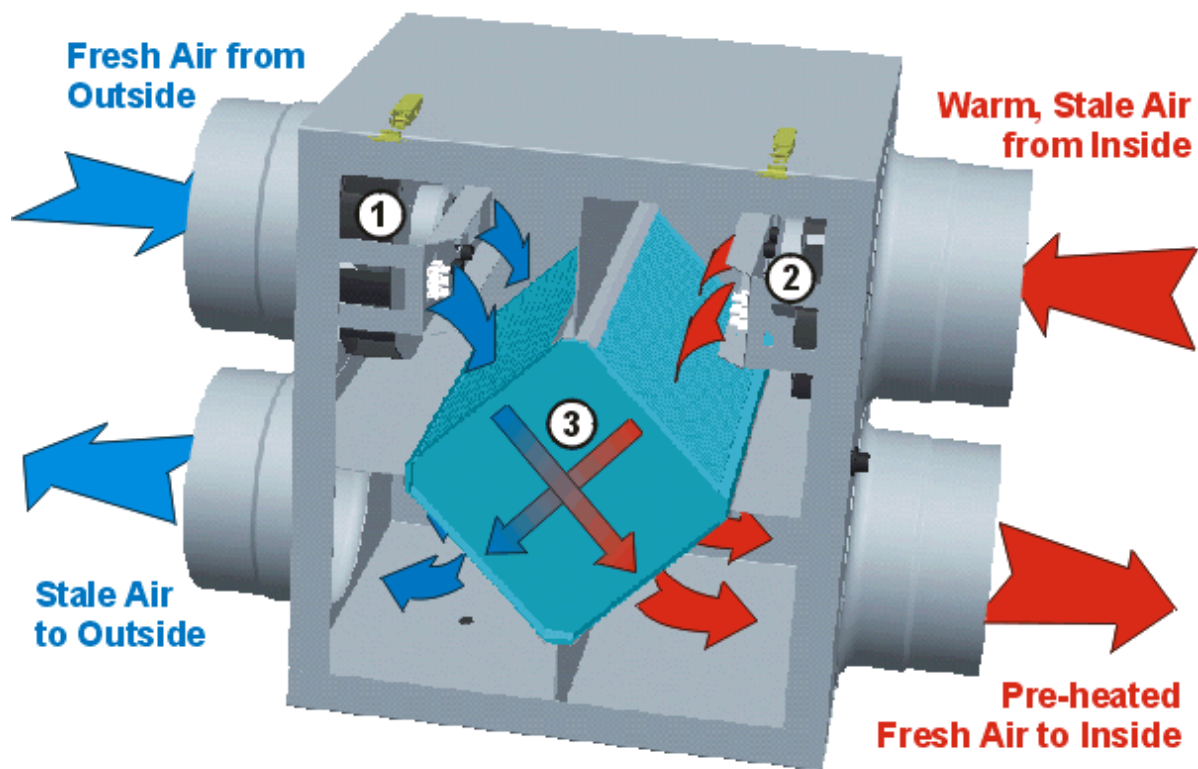


12 inches to 30 inches  
4 MMBtu/yr savings (30 gallons oil)



# Choices and Paybacks

## Heat Recovery



**20 MMBtu/yr savings (153 gallons oil)**





# Choices and Paybacks

## Perspective

### Fairbanks



**HW Heater Efficiency: 51% to 60%**  
**Boiler Efficiency: 80% to 84%**  
**Air Tightness (ACH<sub>50</sub>): 7 to 3**  
**Ceiling Insulation: R-38 to R-48**

**Oil Use: 1452 gal/yr to 887 gal/yr**

**Total Additional Costs: \$1,116**  
**Estimated Savings/yr: \$2,261**  
**Simple Payback Period: 0.5 yrs**



# Policy Priorities

**78,959**

households in Alaska are housing cost-burdened



**16,107**

units need to be built to alleviate overcrowding in the state



**12,635**

homes in Alaska lack complete kitchens and/or plumbing



**14,600**

homes are rated 1-star, burdening households with high energy costs



**318**

new senior living facility beds need to be added annually to keep up with senior population growth



**15,972**

estimated shortage of affordable and available housing units for extremely low-income households



**11%**

increase in new construction rate needed to meet projected population growth



**\$23.25**

household hourly wage required to afford the average 2-bedroom rental in Alaska



**55%**

of homes in Alaska are at higher risk for moisture and indoor air quality issues





# Policy Research Team

Overview | Energy saved by region | Cost saved by region | Air Quality | GHG

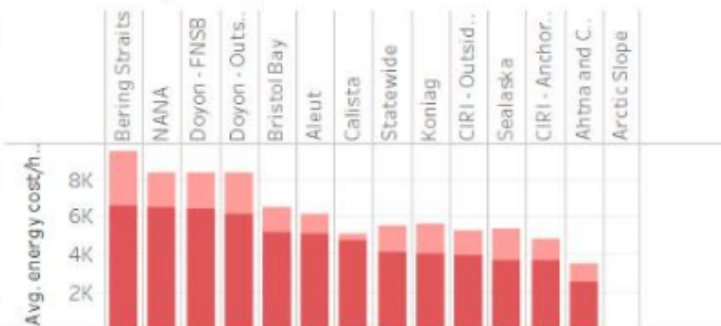
## Average Annual Cost Savings for Single Family Homes by Region

Average Annual Cost Savings per Home by ANCSA Region

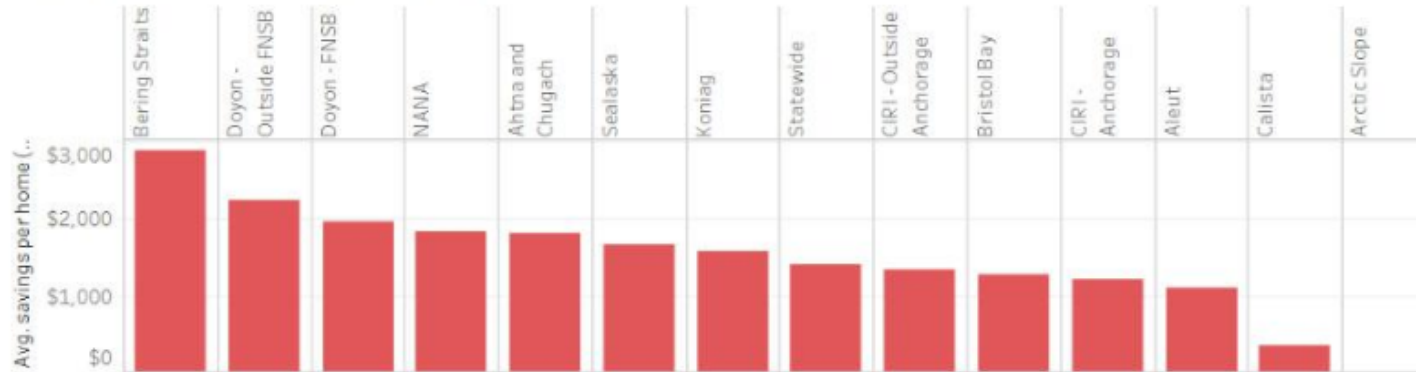


Pre- vs. post-retrofit average annual energy cost per home

Pre-retrofit - light color; post-retrofit - dark color



Average Annual Cost Savings per Home



Tableau





# CALISTA CORPORATION

**6,131**

Total households in the region



**40%**

are overcrowded households  
(with 2 or more people per room)



HIGHEST % IN STATE



**2,096**

homes lack complete bathrooms



HIGHEST % IN STATE



**31%**

of homes are at risk of poor indoor air  
quality due to inadequate ventilation



**23%**

of households spend 30% or  
more of their income on housing





# COOK INLET REGIONAL INC.

**155,910**

Total households in the region



**64%**

of homes are at risk of poor indoor air quality due to inadequate ventilation



HIGHEST % IN STATE



**32%**

of households spend 30% or more of their income on housing



**4%**

are overcrowded households (with 2 or more people per room)



**4,675**

homes are rated 1 Star out of 6 (the lowest score for energy efficiency)



**2,932**

homes lack complete bathrooms



# A HOLISTIC APPROACH

## Water Food Shelter







## A HOLISTIC APPROACH

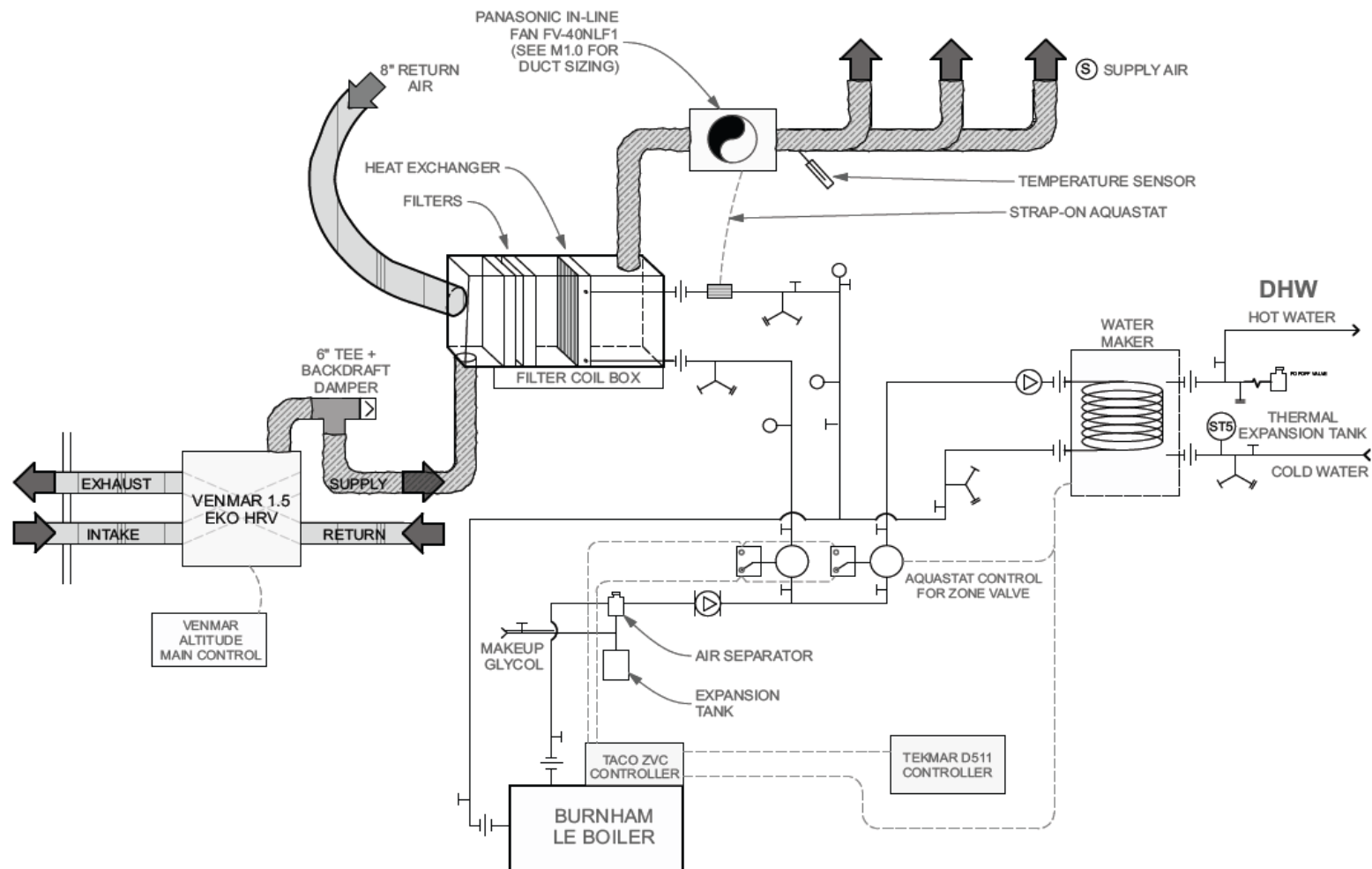
### BrHEAThe- Warm and healthy air





# A HOLISTIC APPROACH

## BRHEATHE SYSTEM SCHEMATIC

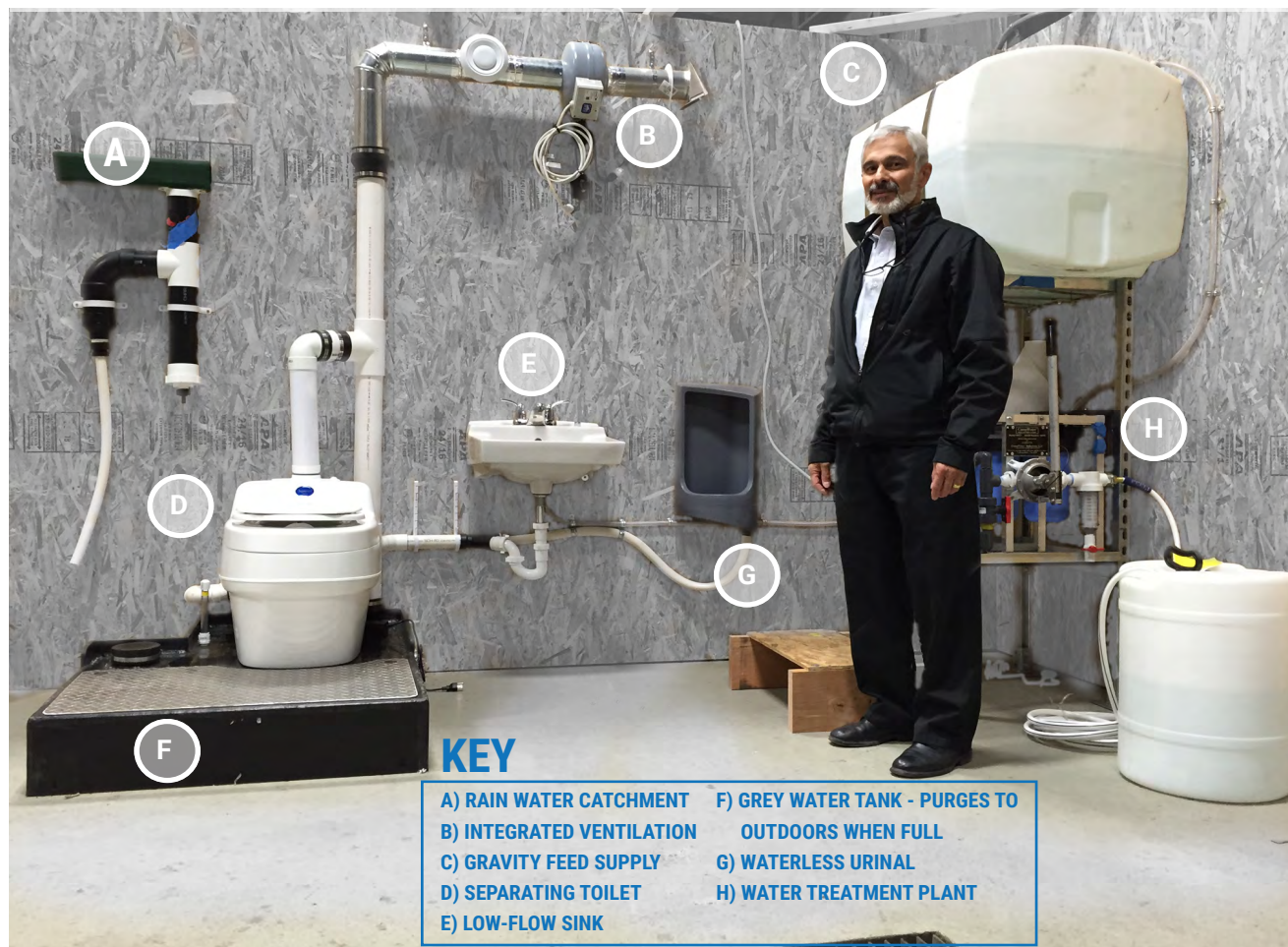






## A HOLISTIC APPROACH

# PASS- Portable Alternative Sanitation System







## A HOLISTIC APPROACH

A Healthy Land  
A Healthy People  
A Healthy Spirit

All of Creation is  
connected



Photo Olga Mesak





Qagaasakung, Quyanaq,  
Quyana, Mahsi',  
Gunalcheesh, Haw'aa, Merci,  
Thank you!

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