ENERGY DESIGN
conference & expo

Multi-Family Green Building Programs

Chris Johnson

Johnson Environmental

Subsidiary of, Integro Services Group, Inc.

Engineers and Architects

- In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

  "This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code /1 hour energy** continuing education requirements."

  For additional continuing education approvals, please see your credit tracking card.

Getting Everyone on the SAME PAGE

- Owners –
- Bankers-
- Architects-
- Construction office-
- Construction in the field –
- Suppliers -

Words to remember…

“I have a box to build and this much money to build it”

Green Building Programs – what we hear

- Landscape design incorporates all native drought resistant plants.
- Computer controlled irrigation systems
- Advanced window glazing- to reduce solar radiant heat loads and decrease HVAC Load
- Roof top Photovoltaics or renewable ready building
- Building envelope improvements using rigid and spray foam insulation
- Variable Refrigerant flow technology HVAC system
- Dedicated Fresh air system
- Wireless lighting controls for lighting system
- Tours and Public Training
- Contractor Training – Certified installation training

Objectives-

Gain a basic understanding of multiple green building certifications

- Energy Focused – ENERGY STAR, DOE Net Zero Ready, Passive
- Sustainable Focused – ICC 700, LEED

Understand the financial reasons and benefits to owners

- Lower Down Payments, Proper utility allowances
- Programs that give points – State Programs, Federal Programs

Comprehend the TEAM Design and Development process

- Its all about trade offs
- Design Build is the way to go or plan on a lot of submittals

Objectives-

Basic Concepts of relating building envelope to sizing then relate to comfort

- High performance buildings need high performance controls
- One change may cause other changes

Recognize how outcomes drive high performance building

HUD allowances

How to use on a 2 Bedroom

Electric Heat = $38.00

Cooling = $9.00

Other = $34.00

Water Heating = $27.00

Range = $12.00
Refrigerator = $13.00

TOTAL = $133.00

Allowances for Tenant-Furnished Utilities and Other Services

U.S. Department of Housing and Urban Development
Office of Public and Indian Housing

OMB Approval No. 2577-0169
(exp. 04/30/2018)

See Public Reporting Statement and Instructions on back

10-1-16

Locality	Unit Type	Date (mm/dd/yyyy)
Sioux Falls Housing and Redevelopment Commission	Multi Family: Apartments/Row Houses/ Semi Detached	

Utility or Service		Monthly Dollar Allowances					
		0 BR	1 BR	2 BR	3 BR	4 BR	5 BR
Heating	a. Natural Gas	$17	$19	$23	$26	$29	$33
	b. Bottle Gas						
	c. Oil / Electric	$24	$28	$38	$49	$59	$69
	d. Coal / Other	$15	$18	$25	$31	$38	$45
Cooking	a. Natural Gas	$2	$2	$3	$4	$4	$5
	b. Bottle Gas						
	c. Oil / Electric	$6	$8	$9	$11	$13	$15
	d. Coal / Other						
Other Electric		$22	$26	$34	$42	$50	$58
Air Conditioning							
Water Heating	a. Natural Gas	$6	$7	$10	$13	$14	$16
	b. Bottle Gas						
	c. Oil / Electric	$16	$19	$27	$34	$39	$43
	d. Coal / Other						
Water		$20	$21	$28	$35	$43	$51
Sewer		$22	$23	$30	$38	$45	$53
Trash Collection		$33	$33	$33	$39	$39	$39
Range/Microwave		$12	$12	$12	$12	$12	$12
Refrigerator		$13	$13	$13	$13	$13	$13
Other – specify		$9 electric/5 gas	$9 electric/ $5 gas	$9 electric/ $5 gas	$9 electric/ $5 gas	$9 electric/ $5 gas	$9 electric/ $5 gas

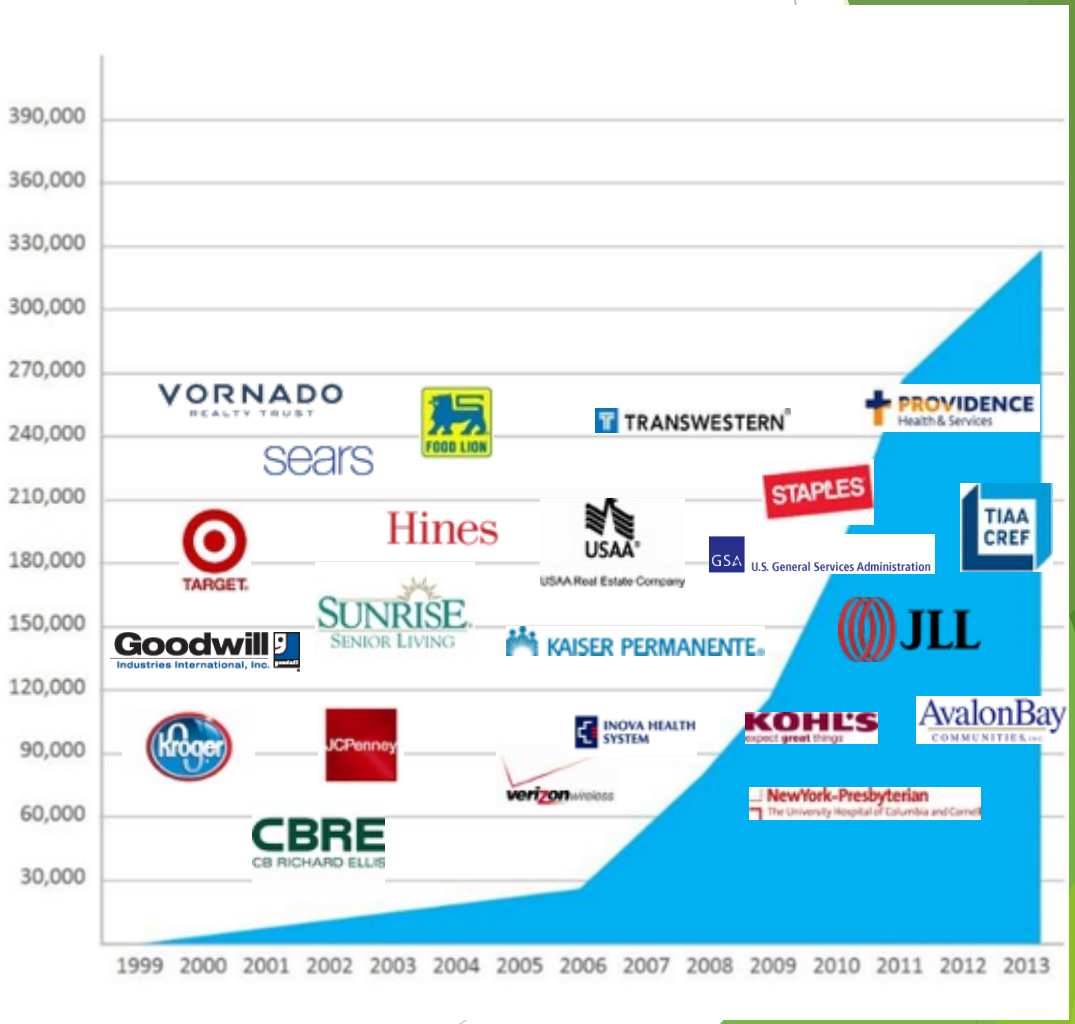
Actual Family Allowances To be used by the family to compute allowance.
Complete below for the actual unit rented.

Name of Family

Utility or Service	per month cost
Heating	$
Cooking	

Model Efficiencies
Existing Buildings – Benchmarking

- Over 75,000 active Portfolio Manager accounts nation-wide
- More than 400,000 properties benchmarking energy use
- More than 90,000 properties benchmarking water use in Portfolio Manager
- More than 165,000 properties benchmark energy/water using web services
- More than 25,000 properties are ENERGY STAR certified



ENERGY STAR

City Money, Housing Non-profit, State Money then budget

8 Units (4 up and 4 down)

- Radiant heating
- Mini-split cooling
- $50.00 per month utilities

Energy Cost and Features

Property
Sioux Falls Affordable Housing
202 S. Summit Ave # 102
Sioux Falls, SD 57104

Organization
Johnson Environmental
605-940-0759
Chris Johnson

HERS
Confirmed
2017-02-21
Rating No:0235
Rater ID:8875892

Weather:Sioux Falls, SD
Pettigrew Manor
88758920235 202 S Summit Ave
_102 Sioux Falls SD 57104 - A1.blg

Builder
Beckman Construction

Annual Energy Costs	$/yr
Heating	107
Cooling	31
Water Heating	35
Lights & Appliances	233
Photovoltaics	-0
Service Charges	195
Total	600
Average Monthly($/Month)	50

Energy Features

Ceiling w/Attic	None
Sealed Attic	None
Vaulted Ceiling	None
Above Grade Wall	x6 16oc OF/R21 G1 U=0.058
Foundation Walls (Cond)	None
Foundation Walls (Uncond)	None
Doors	Therma Tru Fire Door0********** U=0.225
Windows	.27/.20********** U=0.270
Floors	None
Slab Floors	R10 / R10 Unit B**** U=0.046
Infiltration	Htg: 504 Clg: 504 CFM50
Infiltration Measure	Blower door test
Mechanical Ventilation	Exhaust Only: 34 cfm, 25.7 watts.
Interior Mass	None
Mechanical Equipment 1	Heating: Fuel-fired hydronic distribution, 15.2 kBtuh, 95.0 AFUE.
Mechanical Equipment 2	ASHP: Htg: 12.0 kBtuh, 8.2 HSPF. Clg: 12.0 kBtuh, 15.0 SEER.
Mechanical Equipment 3	Water Heating: Conventional, Gas, 0.95 EF.
Programmable Thermostat	Heat=Yes; Cool=Yes
Ducts	NANA
Duct Leakage to Outside	NA
Total Duct Leakage	NA
Lights/Appliances	Rating Tab

Note: Where feature level varies in home, the dominate value is shown.

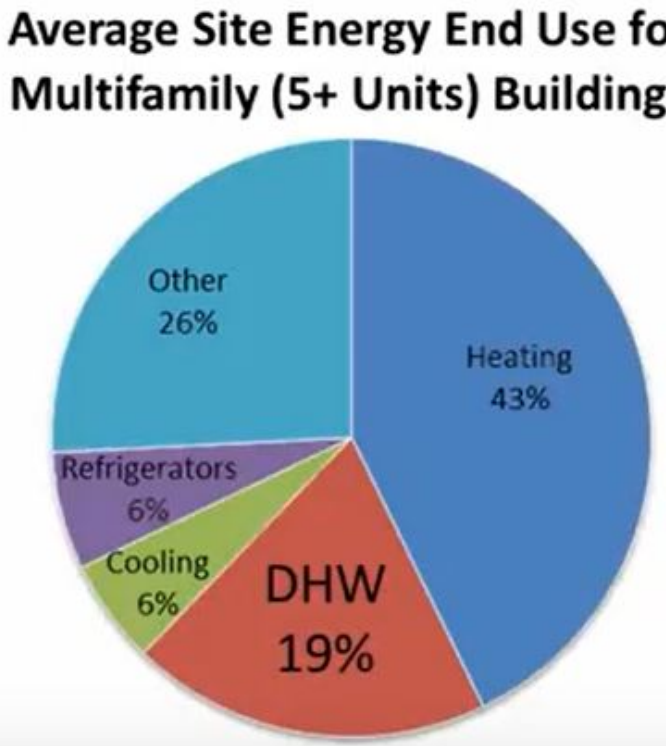
Building Pays

- Heat & Water Heating

- Tenant cost- $30.00

ENERGY STAR

Water Heating is one of the largest multifamily energy uses.



ENERGY STAR

Property	Building A	Building B	Building C	Building D
Annual DHW Cost (incl Recirc Pump Electricity)	$15,900	$31,200	$16,400	$9,200
Installed Cost of Demand/Temp Mod. Controls	$3,000/$2,000	$2,500/$5,300	$3,000	$3,000/$2,000
Demand Control Payback	2.1	1.0	3.0	3.7
Temperature Modulation Payback	11.2	3.0	-	18.5
Demand Control & Temperature Modulation Payback	3.0	2.5	-	4.0

- Average annual cost savings, including interactive effects:
  - 9% with demand controls
  - 3% with temperature modulation controls
  - 12% with both combined
- Worst-case average payback: <4 years for demand

ENERGY STAR

This housing authority has units with $200 + monthly utilities

8 Units (4 up and 4 down)

- Sent out to bid twice
- Has won a state AIA prize
- Zero turn over

Better building - less - floor tubing

Envelope Testing

Blower Door Testing and Air Sealing

$351 Annual Heating

$527 Annual Heating

Every little bit counts

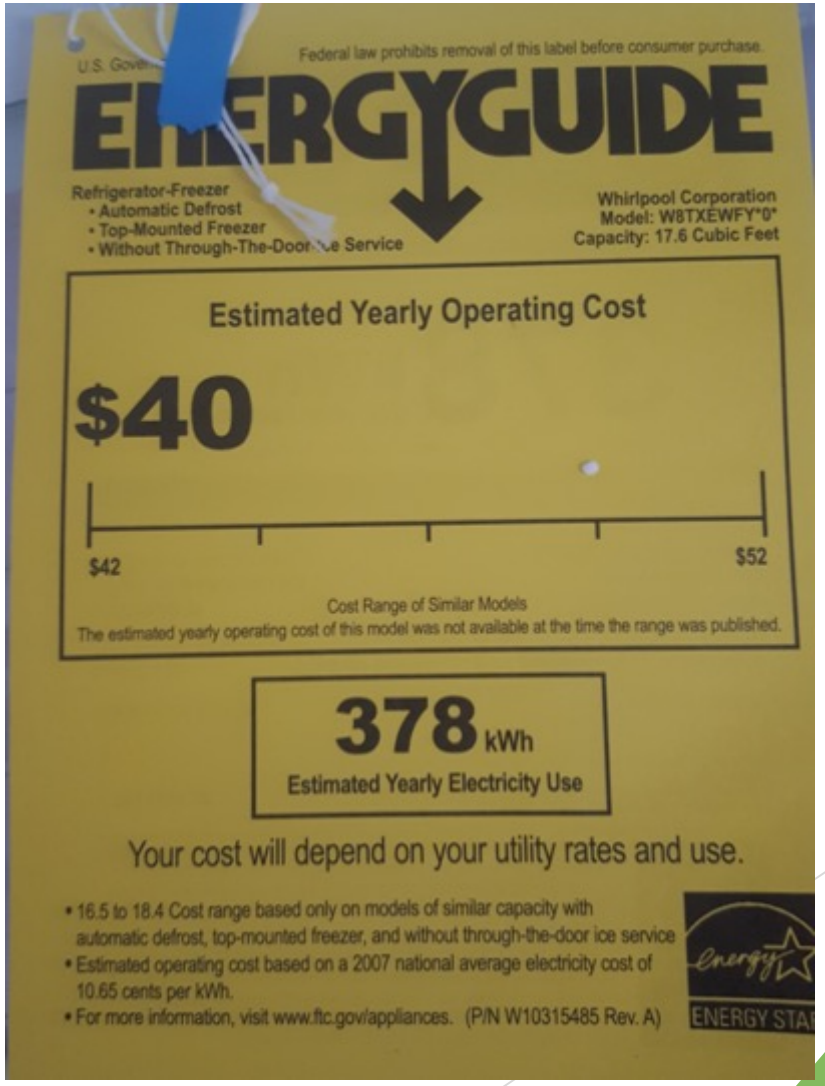
A normal 1990's refrigerator

Your Information

Model:	19.0-21.4 Cubic Feet Top Freezer
Electricity Rate:	$0.1210
Annual Cost:	$186.22
Annual kWh:	1,539 kWh

Flip Your Fridge Savings

$623 over five years



Net Zero

24 Units – Single Meter

- Central Water Heating
- 2015 IECC ENERGY CODE
- $40.00 per month utilities
- Single Meter, all included
- Radiant In-floor Heat
- Mini-split Cooling

Winner

2016 Multifamily category

Estimated Annual Energy Cost			
Use	MMBtu	Cost	Percent
Heating	3.9	$55	11%
Cooling	3.7	$30	6%
Hot Water	3.1	$108	21%
Lights/Appliances	15.0	$326	63%
Photovoltaics	-0.0	$-0	-0%
Service Charges		$0	0%
Total	25.9	$519	100%

Net Zero

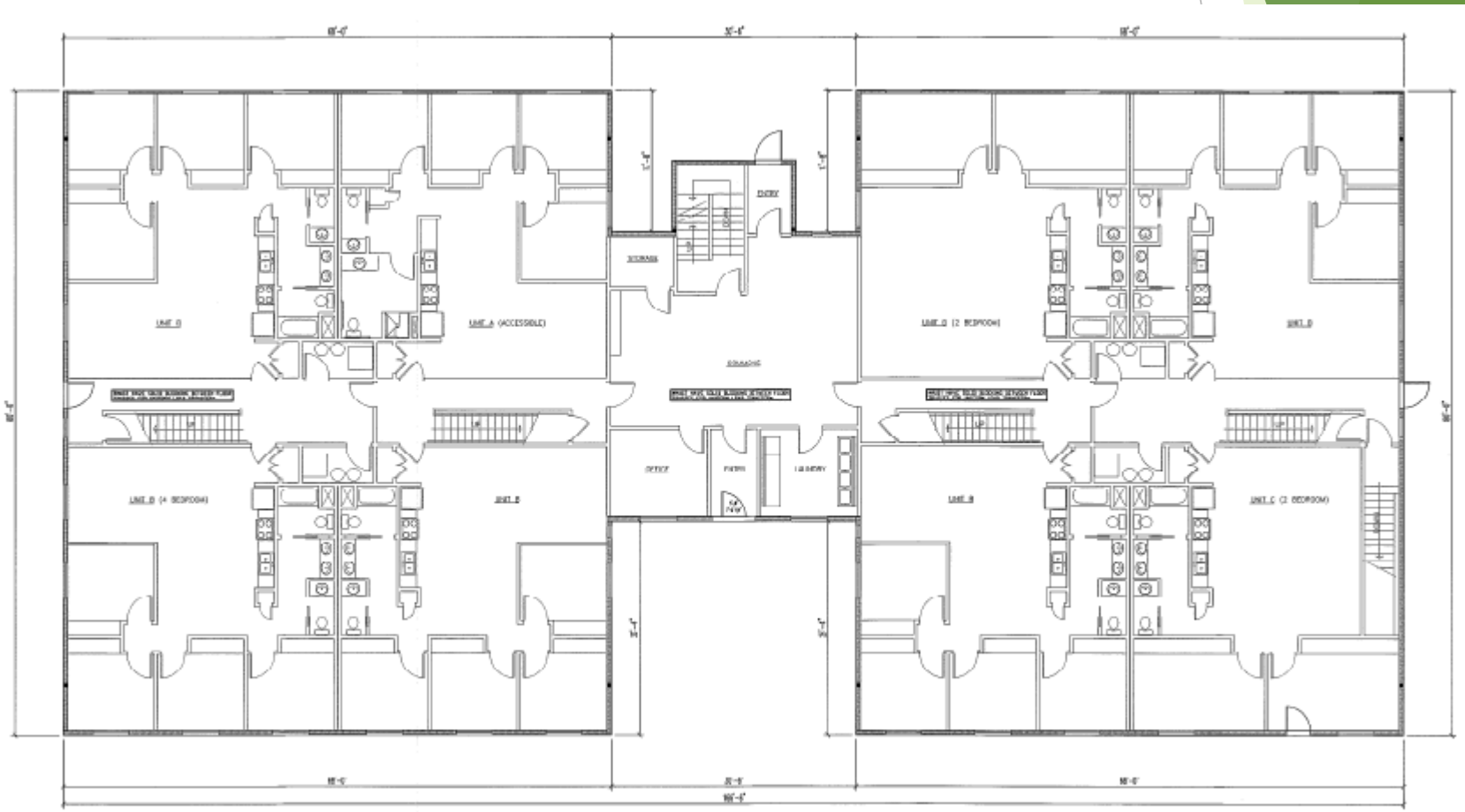
24 Units

- HERS 38
- 1,235 sqft
- 92 bedrooms
- Student Housing
- $300 a Room

BUILDING EXCELLENCE AWARDS
SIPA
14th ANNUAL

Winner

2016 Multifamily category



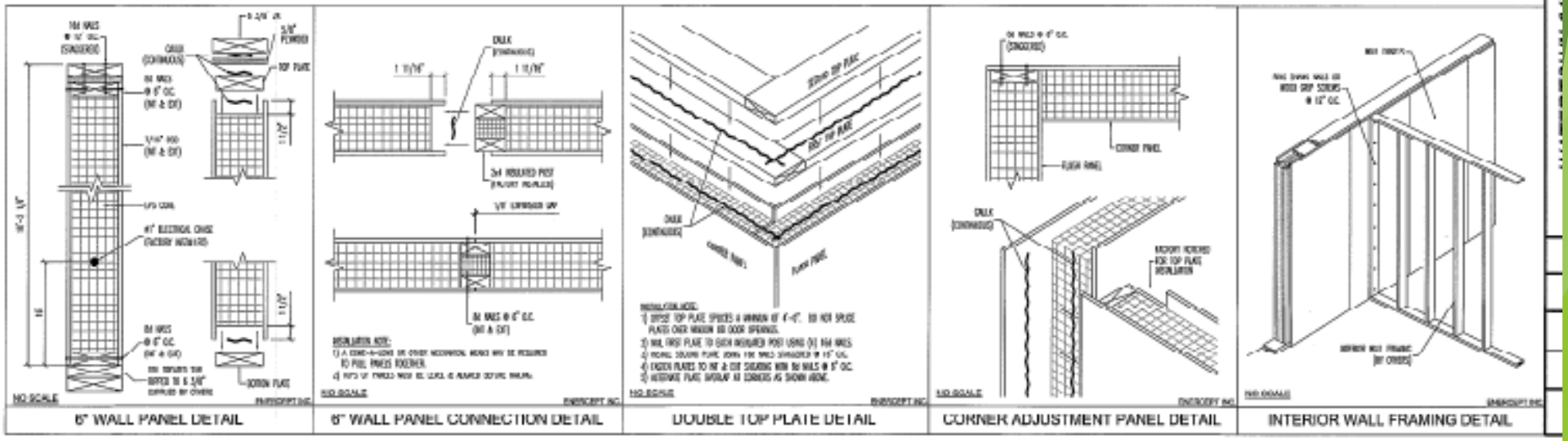
Net Zero

24 Units

- HERS 38
- 1,235 sqft
- 6 inch SIP Panel shell

Winner
2016 Multifamily category

Actual Heating $30-$36 a month
Includes 55 Car garage and Ramp



ENERGY STAR

HUD MIP Reduction

320 Units

- Central Water Heating
- 2015 IECC ENERGY CODE
- $36.00 per month utilities
- Single Meter, all included

Energy Cost and Features

Property
Graystone Heights LLC
5100 S. Graystone
Sioux Falls, SD 57108

Organization
Johnson Environmental
605-940-0759
Chris Johnson

HERS
Projected Rating
Rater ID:8875892

Weather:Sioux Falls, SD
Greystone, Unit C2 First Floor
Greystone C1 Unit First Floor, 2 Bedroom.blg

Builder
Graystone Heights LLC

Annual Energy Costs	$/yr
Heating	49
Cooling	41
Water Heating	69
Lights & Appliances	269
Photovoltaics	-0
Service Charges	0
Total	429
Average Monthly($/Month)	36

Energy Features

Ceiling w/Attic	None
Sealed Attic	None
Vaulted Ceiling	None
Above Grade Wall	x6 16oc BF/R23 G1*** U=0.056
Foundation Walls (Cond)	None
Foundation Walls (Uncond)	None
Doors	Fiberglass/Foam Fill*** U=0.168
Windows	grays .28/.34 slider U=0.280
Floors	None
Slab Floors	None
Infiltration	Htg: 300 Clg: 300 CFM50
Infiltration Measure	Blower door test
Mechanical Ventilation	Exhaust Only: 25 cfm, 14.5 watts.
Interior Mass	None

HUD is $133.00

ENERGY STAR

HUD MIP Reduction

320 Units

- Central Water Heating
- Boiler heated parking garage
- Water heating system – controls
- Pool Heaters

ENERGY STAR
Reduced Down Payment
$6,000,000

GRAYSTONE HEIGHTS

- Landscape design incorporates all native drought resistant plants.
- Computer controlled irrigation systems
- Advanced window glazing- to reduce solar radiant heat loads and decrease HVAC Load
- Roof top Photovoltaics or renewable ready building
- Building envelope improvements using rigid and spray foam insulation
- Variable Refrigerant flow technology HVAC system
- Dedicated Fresh air system – constant run bath fan…
- Wireless lighting controls for lighting system
- Recycle Program during construction to divert from landfill
- Monthly tours for public officials

ENERGY STAR
Sub Metering

GRAYSTONE HEIGHTS

Master Meter

- Revenue-grade hardware for measuring electricity demand and consumption (may be analog or smart/communicating interval meter)

Direct Meter

- Revenue-grade hardware installed at a facility intended to account for electricity in specific units, floors, or spaces

Submeter

- Supplemental hardware that provides more granular consumption and demand data

ENERGY STAR
Sub Metering

GRAYSTONE HEIGHTS

Feed-through socket submeter

CT-based submeter

Non-socket-type submeter

ENERGY STAR Drivers

GRAYSTONE HEIGHTS

Programs | Rebates

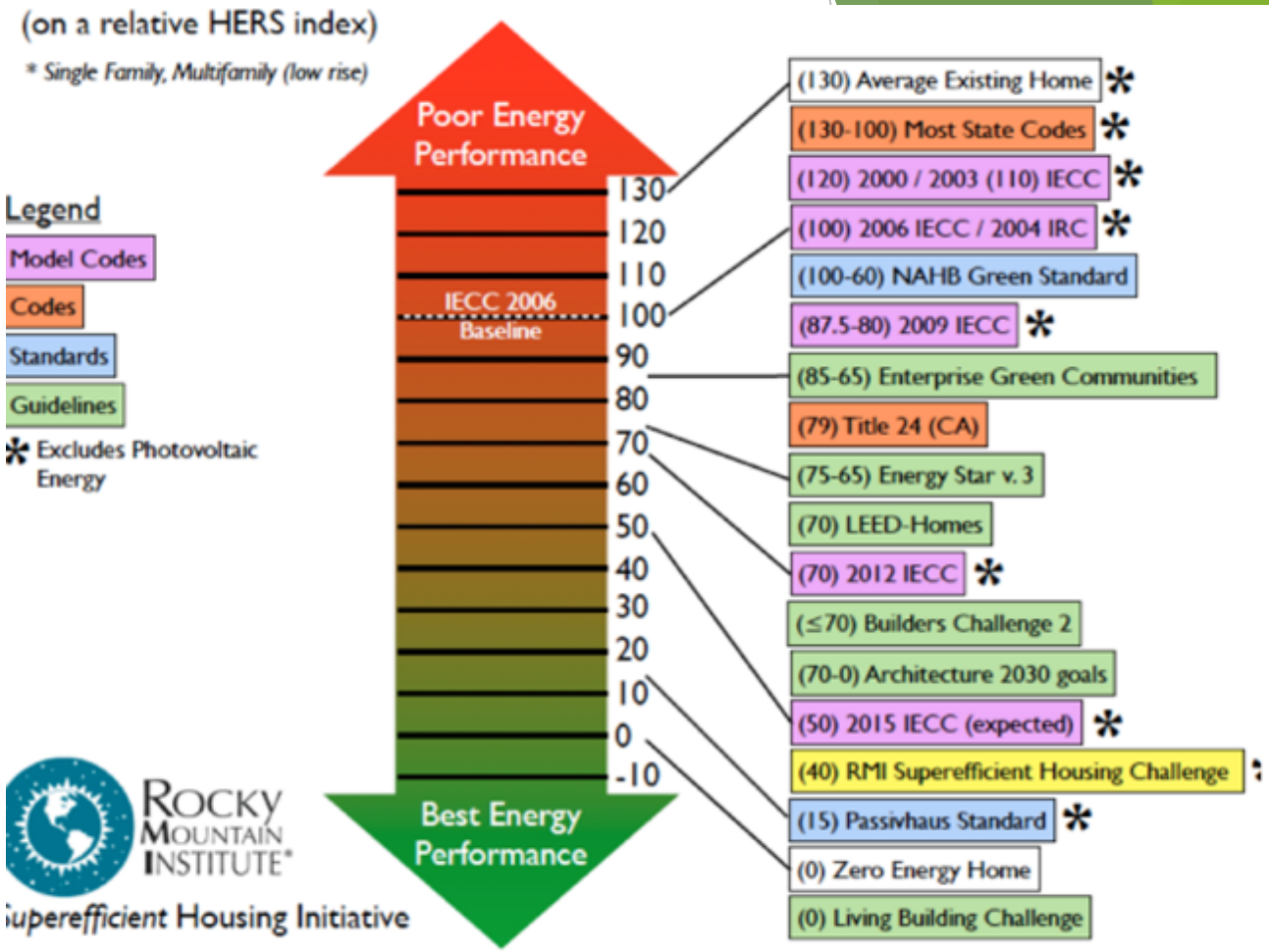
For Commercial Customers in South Dakota

Due to increased participation, 2017 program funding for the electric Nonresidential Equipment and Custom programs is depleting. Applications received will be processed and paid on a first-come, first-served basis while 2017 funding remains available. Funding remains available for residential and nonresidential natural gas programs and measures.

- Lighting Equipment
- Heating and Cooling Equipment
- Variable Speed Drives
- Custom Systems
- Commercial Energy Solutions

Energy Focused

- HUD Reduction in M.I.P. 40 Basis Points
- Lower Down Payments
- More Comfortable Buildings
- Federal Tax Credit, $2,000 per unit
- Federal Housing Standards 2015
- Wyoming 2015 with $3,000
- Iowa has 2015 Code, with $3,500 rebate



Passive House

30 Units

- Central Water Heating
- Passive House
- $55.00 per month utilities
- Tenant Pays Electric

Majestic Ridge Comparison
***Using 2 Bedroom Second Floor Unit**

Scenario 1
Normal Energy Star Building tenant pays gas, electric. Bath Fan
Gas Furnace , Electric Water Heater

Annual Energy Costs

Heating	$	50.00
Cooling	$	39.00
Water Heating	$	277.00
Lights & Appliances	$	307.00
Service Charges	$	220.00
Total	$	892.00
Average Monthly	$	74.00

Scenario 2
Tenant pays heating gas/Electric, bath fan.
Building pays hot water

Annual Energy Costs

Heating	$	50.00
Cooling	$	39.00
Water Heating	$	64.00
Lights & Appliances	$	307.00
Service Charges	$	220.00
Total	$	680.00
Average Monthly	$	57.00

Scenario 3
Tenant pays Electric, Panasonic Micro HRV with Mini Split Heat Pump
Building pays Gas Water Heater

Annual Energy Costs

Heating	$	138.00
Cooling	$	30.00
Water Heating	$	64.00
Lights & Appliances	$	307.00
Service Charges	$	124.00
Total	$	663.00
Average Monthly	$	55.00

PHIUS
Passive House Institute US

HUD is $133.00

Passive House

PHIUS
Passive House Institute US

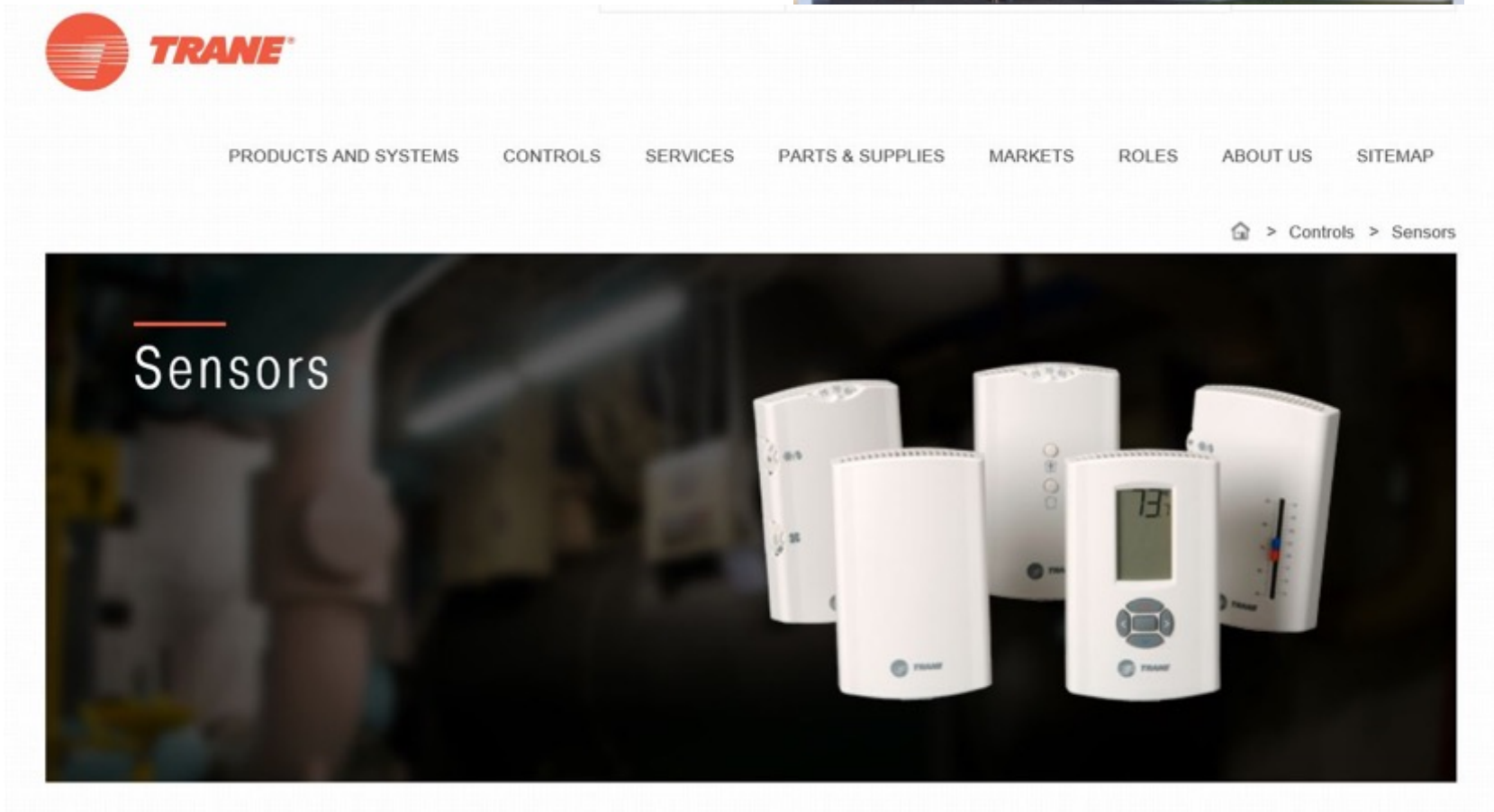
- Landscape design incorporates all native drought resistant plants.
- Computer controlled irrigation systems
- Advanced window glazing- to reduce solar radiant heat loads and decrease HVAC Load
- Roof top Photovoltaics 14 Kw
- Building envelope improvements using rigid and spray foam insulation
- Variable Refrigerant flow technology HVAC system – Mini splits
- Dedicated Fresh air system – Each floor gets ERV
- Wireless lighting controls for lighting system
- Recycle Program during construction to divert from landfill

Passive House Why?

- Governor's Office
- State Housing Authority
- Set up a competition – 3 groups
- Prize… $500,000 Tax credits

Passive House
Why I like it…

Passive House Institute US



Passive House

Foundation Walls insulation - R-88

Slab Insulation – R-28

Passive House

Wall Insulation R-40 Reduced Thermal Bridging

What happened??? New engineer, new wall company, new framing crew

Had to add PV at this point to the project

What we would do NEXT time….

The wall panel company needs to be part of TEAM

Move to a SIP’s wall

Passive House

Roof R-87

Roof truss filled with blown in fiberglass

More foam… 22 inches

Changed during construction – thru drains to slope

Air Sealing ?

Passive House

Windows

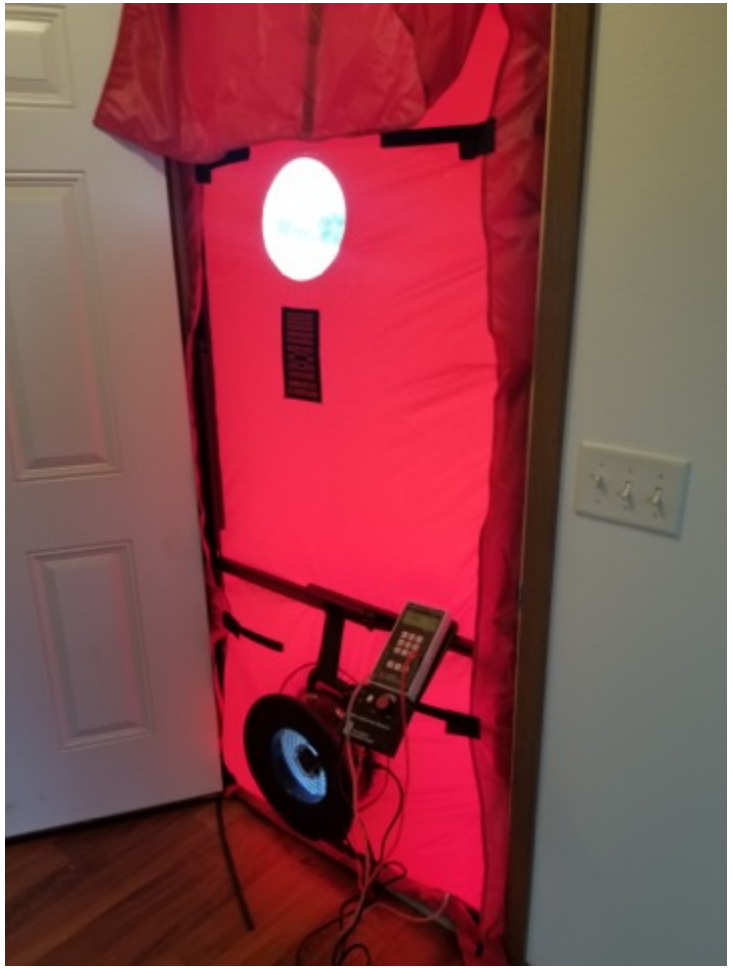
One spot the TEAM fell apart….

Flashing mid set window?

Framers budget?

Air Sealing ?

Passive House



Air Sealing and Testing – two ways
whole building
unit = 60 CFM blower door

ICC 700

Energy Cost and Features

Property
G.A. Haan Development
1872 17th Ave North #2
Wahpeton, ND 58075

Organization
Johnson Environmental
605-940-0759
Chris Johnson

HERS
Confirmed
2017-04-13
Rater ID:8875892

Weather:Fargo, ND
Kennedy Park Unit A
Unit #2.blg

Builder
G.A. Haan Development

Annual Energy Costs	$/yr
Heating	243
Cooling	33
Water Heating	75
Lights & Appliances	288
Photovoltaics	-0
Service Charges	162
Total	801
Average Monthly($/Month)	67

Energy Features

Ceiling w/Attic	R60 Blow Open G1********* U=0.016
Sealed Attic	None
Vaulted Ceiling	None
Above Grade Wall	x6 16oc OF/R21 G1 U=0.058
Foundation Walls (Cond)	None
Foundation Walls (Uncond)	None
Doors	Fiberglass/Foam Fill U=0.168
Windows	Low E .28/.20 U=0.280

40 Units Townhouse Style

- State money involved
- Gas Heat and Water Heating
- Energy Star Path
- $67.00 per month utilities

ICC 700

- Landscape design incorporates all native drought resistant plants.
- Computer controlled irrigation systems
- Advanced window glazing- to reduce solar radiant heat loads and decrease HVAC Load
- Roof top Photovoltaics or renewable ready building
- Building envelope improvements using rigid and spray foam insulation
- Dedicated Fresh air system – constant run bath fan
- Recycle Program during construction to divert from landfill
- Maintenance and tenant education

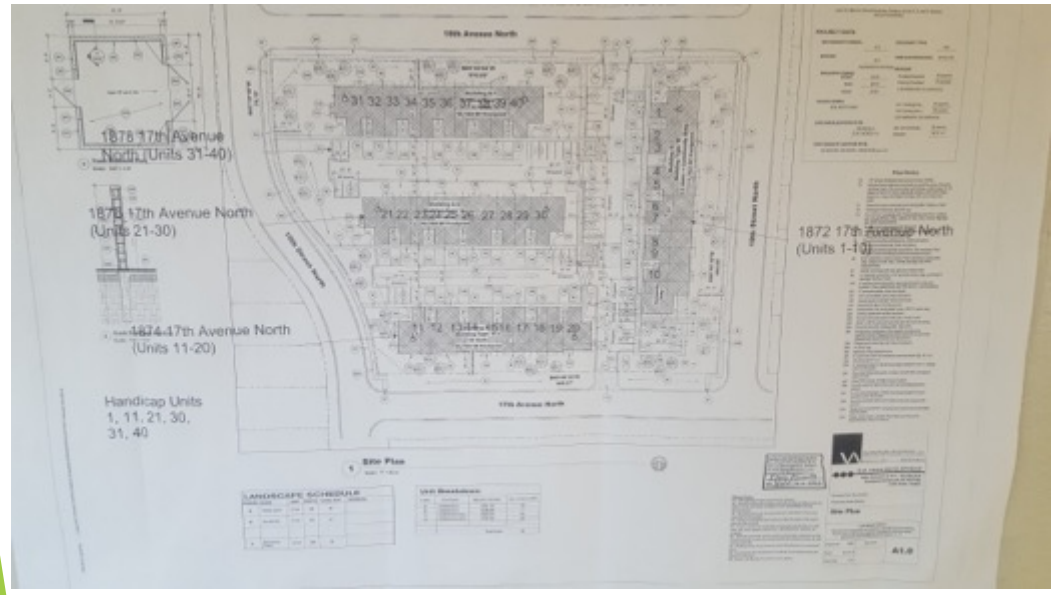
ICC 700

- Classes and training
  - Tyvek school 1 day training to be certified installers
  - Job site superintendent came here…

ICC 700

- Classes and training
  - First building HVAC company used sealed duct work. 4 cfm per sqft

ICC 700



- Challenges
  - Winter build – ground cover timing
  - Air sealing – first blower door testing
  - Submittals – Value Engineering

LEED for Homes

16 Units Townhouse Style

- In-fill lot
- Gas Heat and Water Heating
- Energy Star
- Completed 2012

LEED for Homes

Assemble and involve a project team to meet the three criteria below:

a) Include team members, in addition to the builder and verification team, whose capabilities include at least three of the following skill sets:

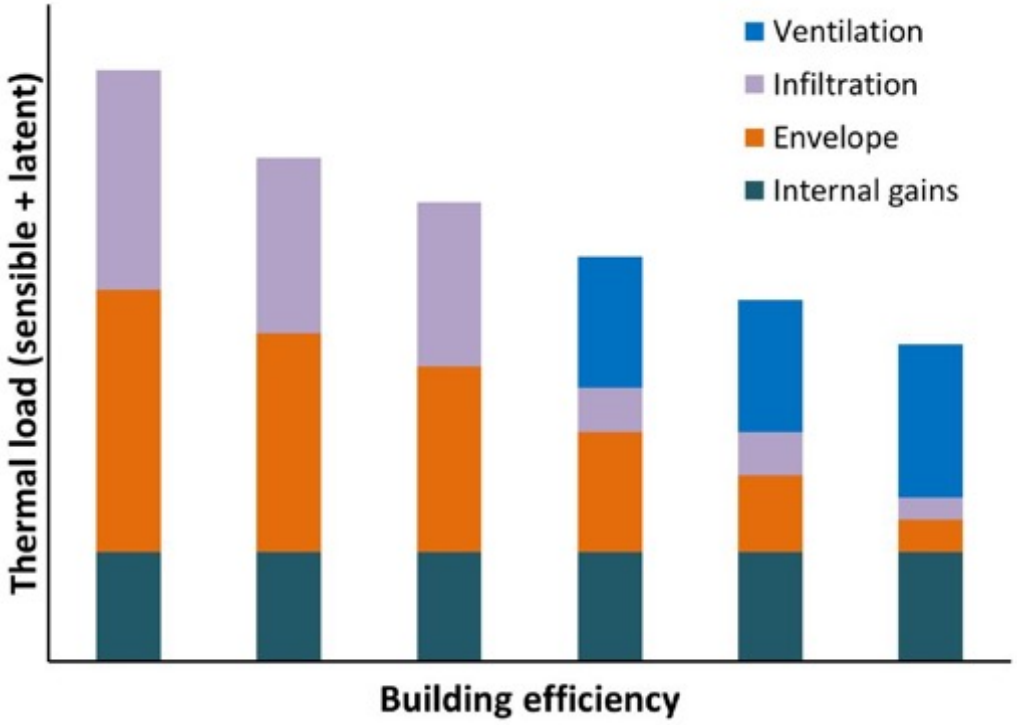
- architecture or residential building design;
- mechanical or energy engineering;
- building science or performance testing;
- green building or sustainable design; and
- civil engineering, landscape architecture, habitat restoration, or land-use planning.

b) Involve all team members referenced above in at least three of the following phases of the home design and construction process:

- conceptual or schematic design;
- LEED planning;
- preliminary design;
- energy and envelope systems analysis or design;
- design development;
- final design, working drawings or specifications; and
- construction.

c) Conduct meetings with the project team at least monthly to review project status, introduce new team members to project goals, discuss problems, formulate solutions, review responsibilities, and identify next steps.

LEED for Homes



First buildings to deal with humidity problems.

LEED for Homes

- **High = 450 cfm/ton**
- **Baseline = 400 cfm/ton**
- **Low = 350 cfm/ton**

Manufacturer's Performance Data

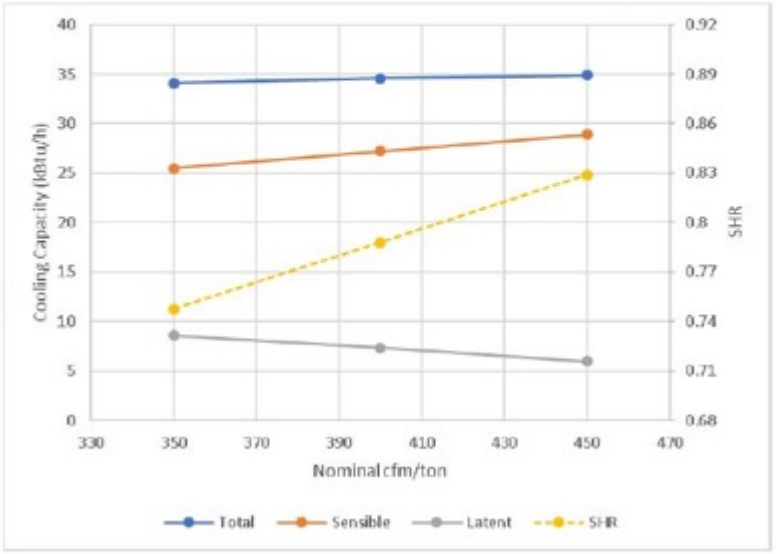
EVAPORATOR AIR		75 (23.9)			85 (29.4)	
CFM	EWB °F (°C)	Capacity MBtuh		Total System KW**	Capacity MBtuh	
		Total	Sensi		Total	Sensi
1050	72 (22.2)	40.58	21.42	2.31	39.93	20.93
	67 (19.4)	37.70	26.94	2.31	35.20	26.34
	63 (17.2)††	35.48	28.09	2.32	34.06	28.48
	62 (16.7)	34.87	32.22	2.32	33.53	31.59
	57 (13.9)	34.27	34.27	2.33	33.16	33.16
1200	72 (22.2)	40.97	22.55	2.37	39.26	21.96
	67 (19.4)	38.15	28.79	2.37	36.60	28.19
	63 (17.2)††	35.99	27.83	2.38	34.54	27.22
	62 (16.7)	35.60	35.60	2.38	34.41	34.41
	57 (13.9)	35.56	35.56	2.38	34.36	34.36
1350	72 (22.2)	41.20	23.64	2.43	39.44	23.04
	67 (19.4)	38.46	30.90	2.43	30.86	29.99
	63 (17.2)††	36.06	29.53	2.43	34.86	29.90
	62 (16.7)	35.61	35.61	2.43	35.33	35.33
	57 (13.9)	35.57	35.57	2.43	35.29	35.29

Increase in cfm/ton results in:

-Decrease in latent capacity

-Increase in sensible capacity

-Increase in sensible heat ratio (SHR)



First buildings to deal with humidity problems.

Thanks

Engineers and Architects
Helping Build Healthy and Efficient Buildings

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Sioux Falls SD 57104
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