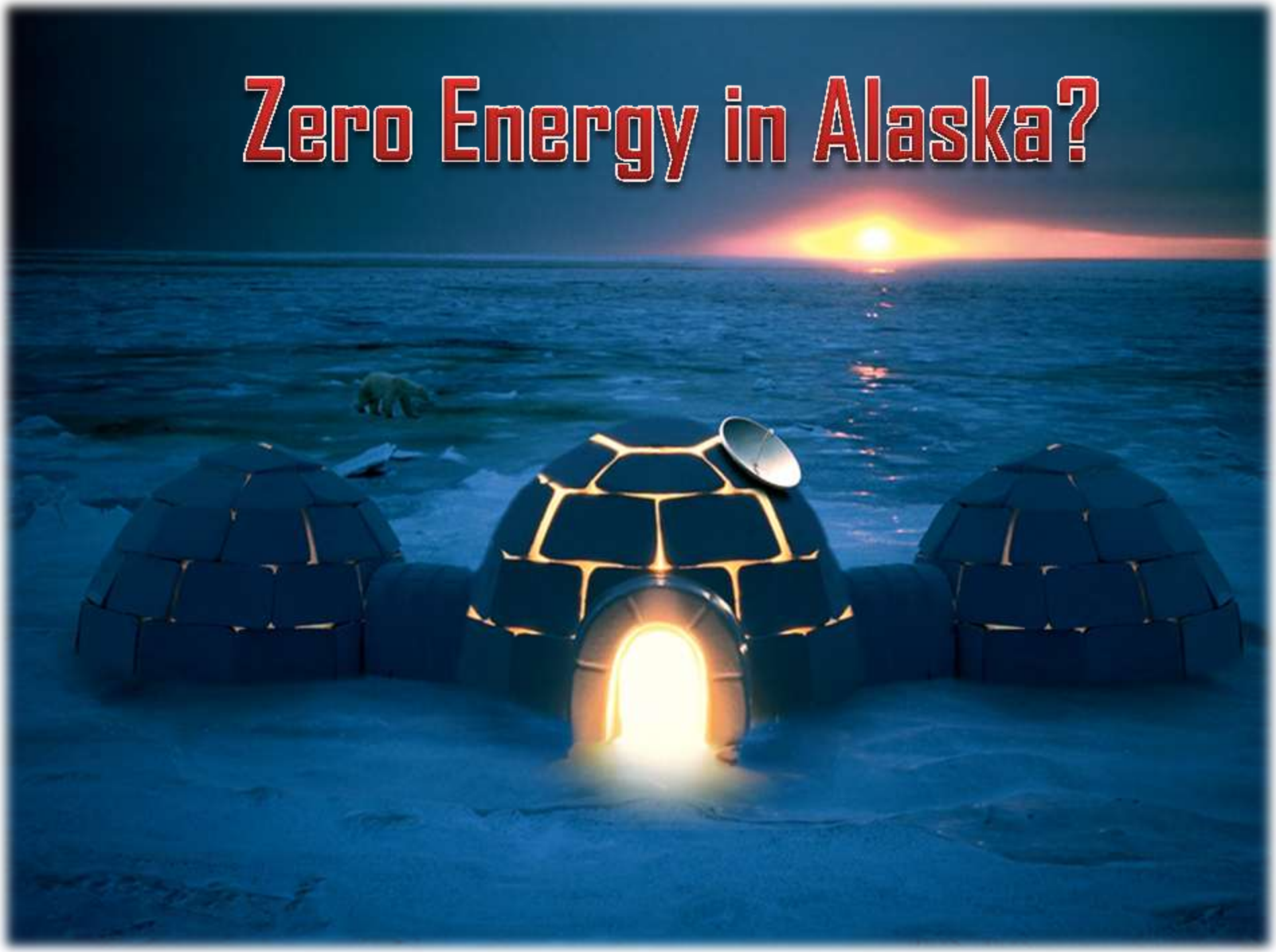

Zero Energy in Alaska?

ZeroEnergy in Alaska?

Thorsten Chlupp

Cold Climate Housing Research Center

CCHRC

thorsten@cchrc.org

Thank you.


How many $$$ can we burn ?

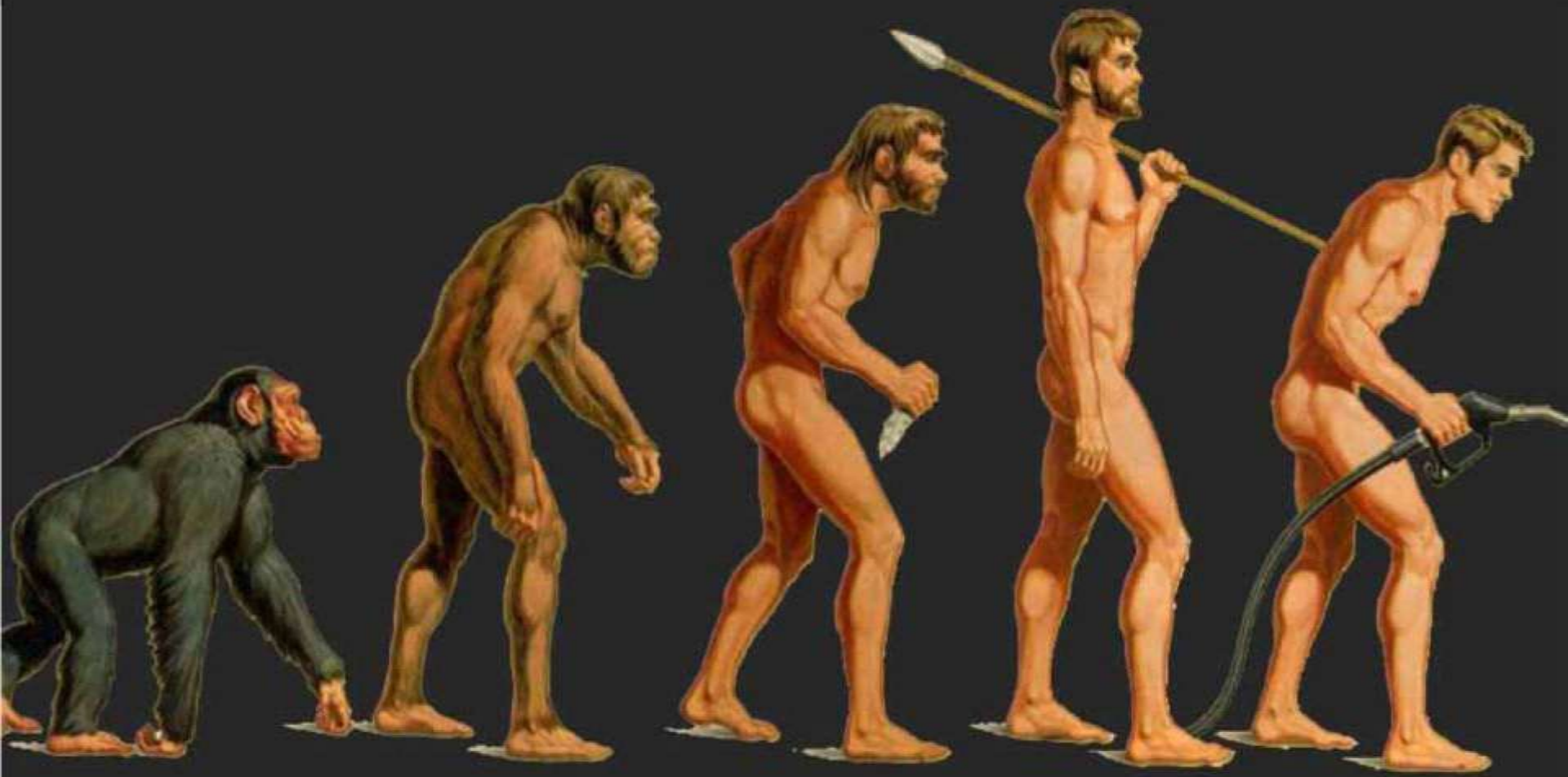
Business as usual

Turn up the heat...

Where are we Going?

“evolution”

We know we are in trouble!



The trouble is that we are still arguing about it!

We know we are in trouble – have a fix:

We know we are in trouble – have a fix:

Building in the Arctic is difficult and expensive.

1. Extreme Climate

2. Remote Location
- High transportation costs

3. Short Building Season

4. Two month of zero passive energy gain

NetZero Home

1. NO Heating System

2. No Utility Costs

3. PLUS – Comfort!

4. In Alaska???

NetZero Home

1. NO Heating System

2. No Utility Costs

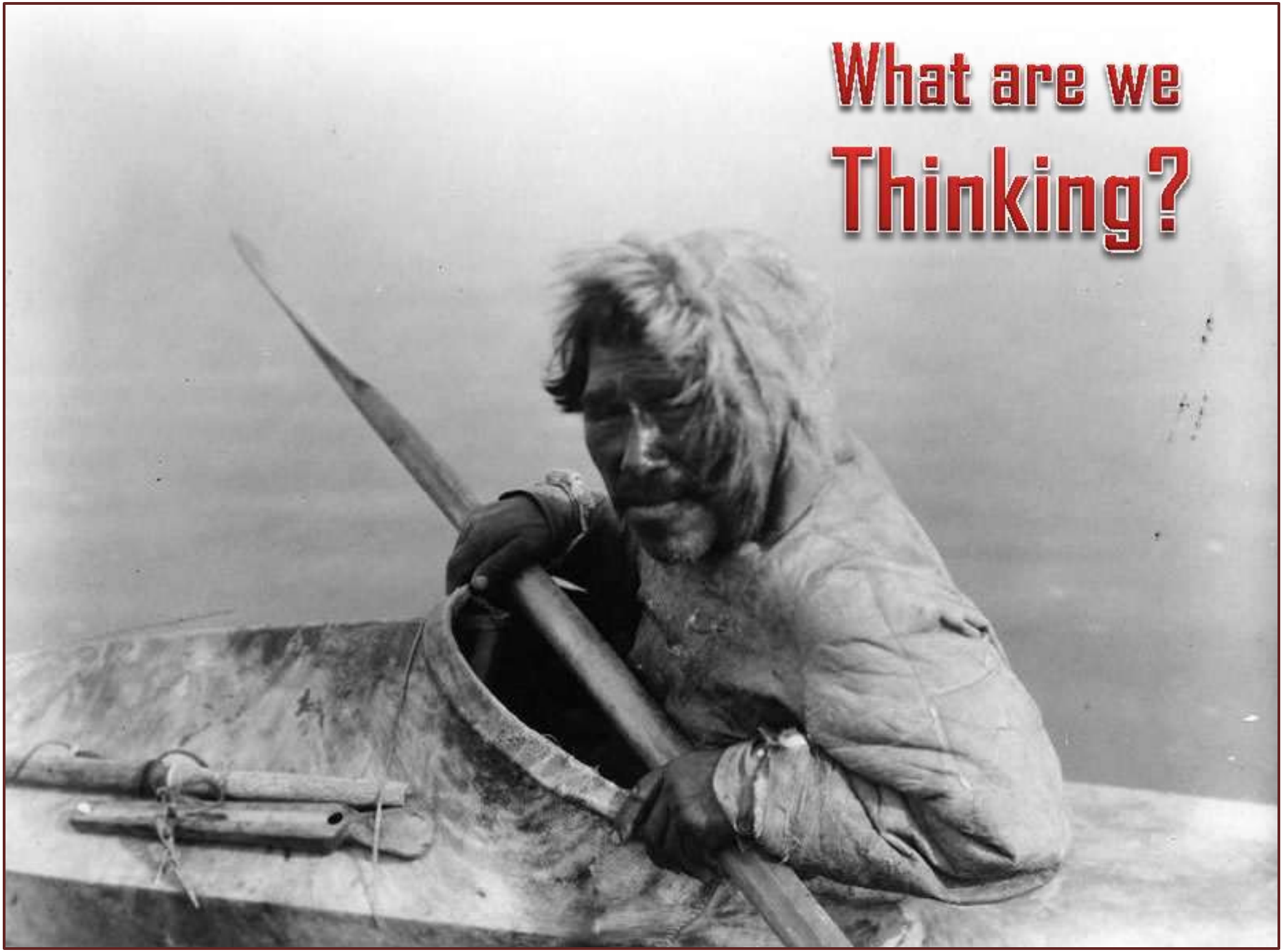
3. PLUS – Comfort!

4. In Alaska???

Impossible!

No? Seriously…

…there is nothing new.

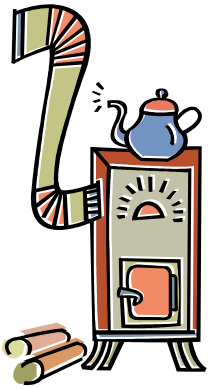

What are we
Thinking?

NetZero Home

Zero net energy consumption and zero carbon emissions annually

NetZero Home

The energy balancing game

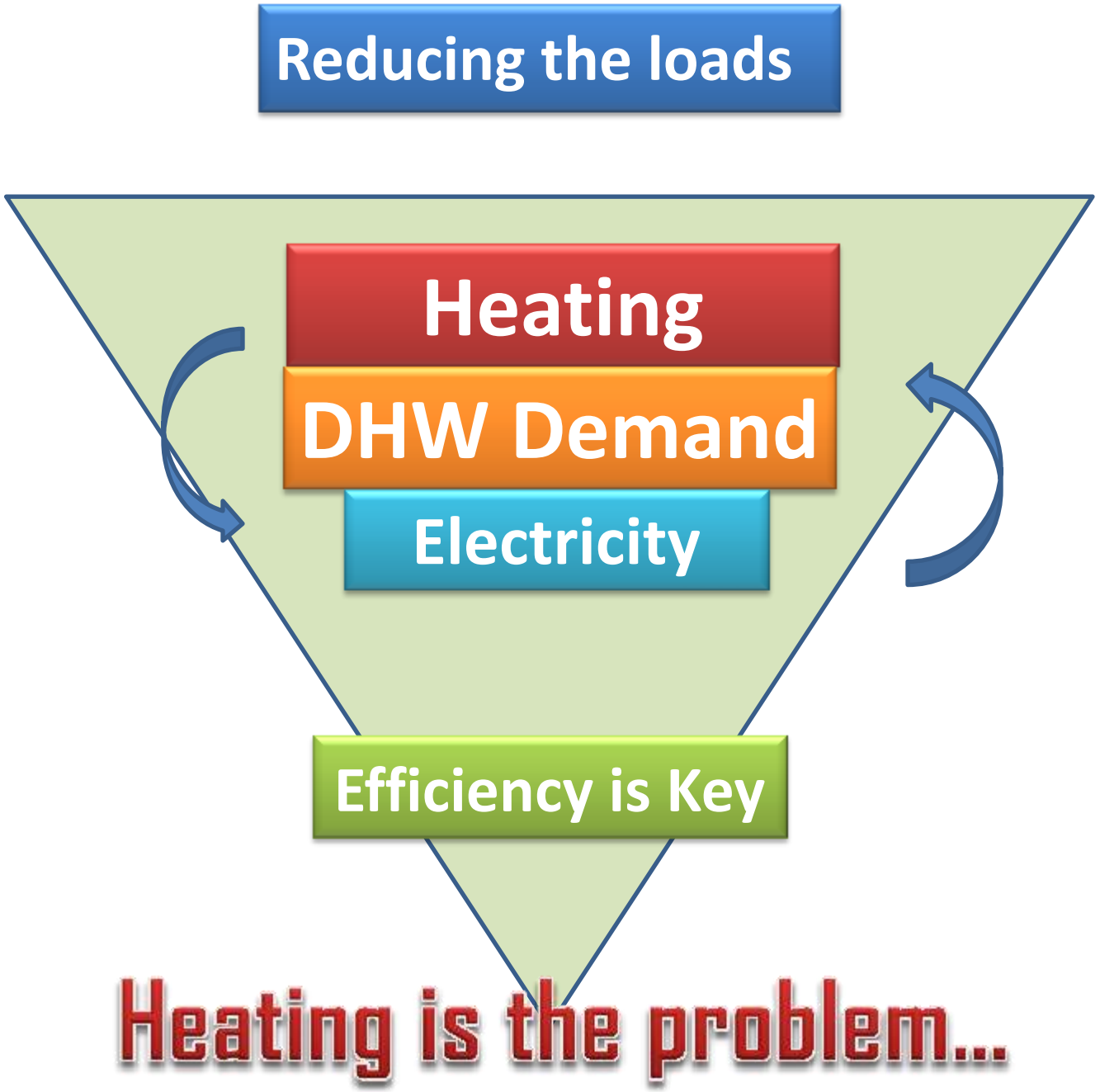


Net energy consumed

Net energy produced

Net ZERO

Or NOT.

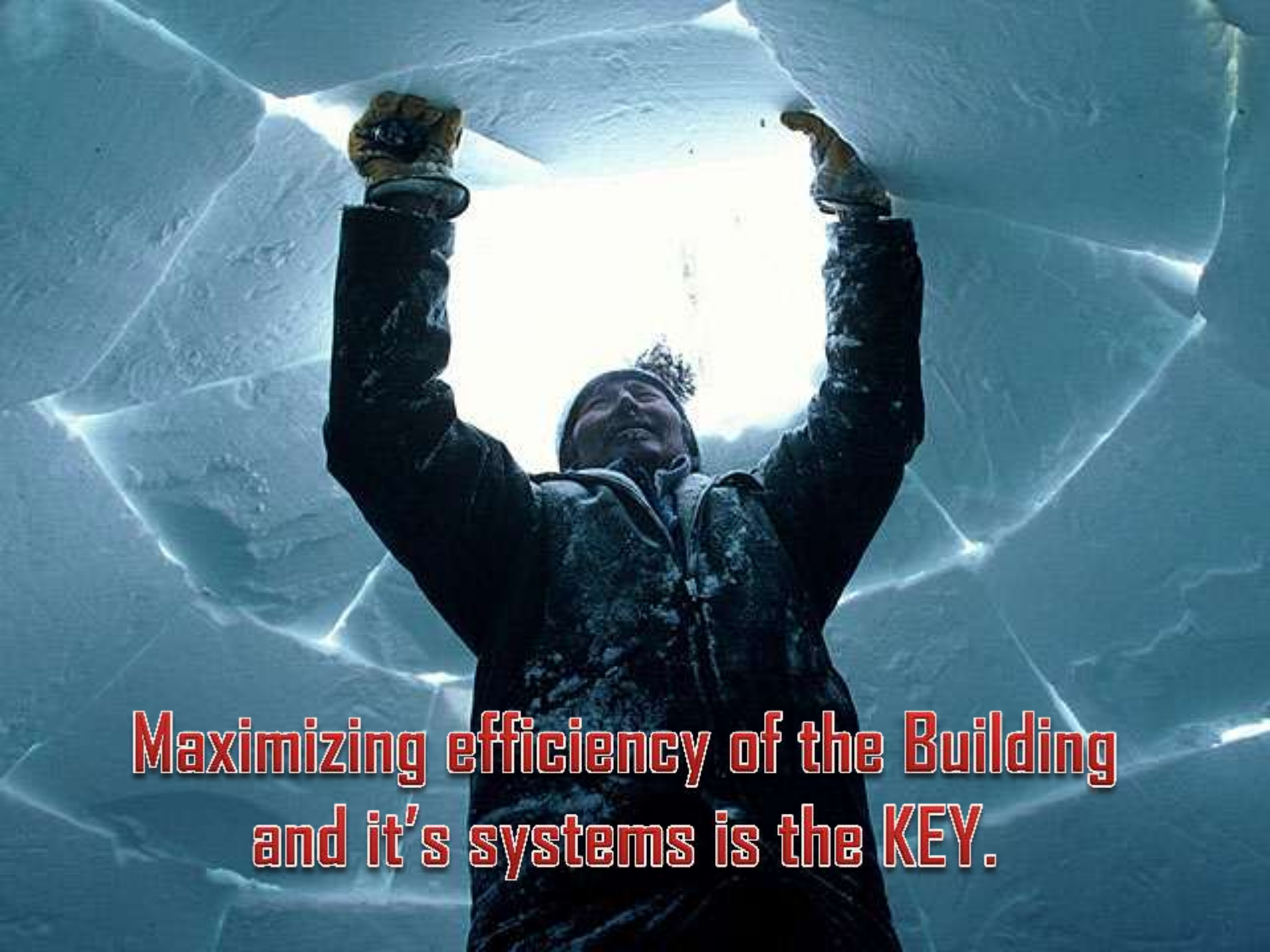

Reducing the loads
Heating
DHW Demand
Electricity
Efficiency is Key
Heating is the problem...

Passiv Haus

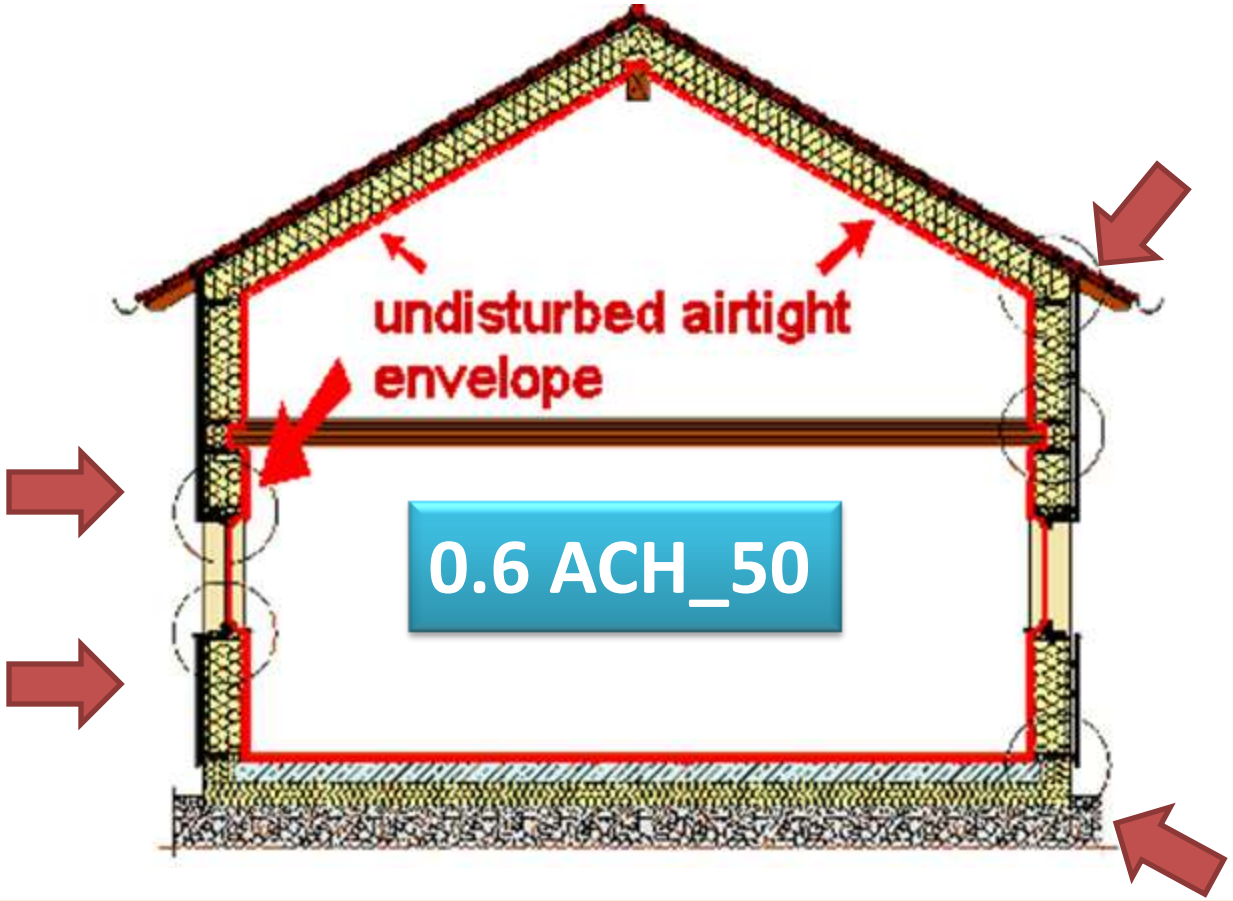
VS

NetZero Home

The Baseline


Maximizing efficiency of the Building
and it's systems is the KEY.

Passiv Haus – The Key Principles



Heating demand @ 4.75 kBTU/(ft²yr)

Energy demand @ 11.1 KWh/(ft²yr)

The SunRise Home

The SunRise Home

Energy Demands with Reference to the Treated Floor Area

Treated Floor Area: 2210 ft²

	Applied:	Monthly Method	PH Certificate:	Fulfilled?
Specific Space Heat Demand:	4.29	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	Yes
Pressurization Test Result:	0.30	ACH_{50}	0.6 ACH_{50}	Yes
Specific Primary Energy Demand (DHW, Heating, Cooling, Auxiliary and Household Electricity):	14.9	kBTU/(ft²yr)	38.0 kBTU/(ft²yr)	Yes
Specific Primary Energy Demand (DHW, Heating and Auxiliary Electricity):	6.9	kBTU/(ft²yr)		
Specific Primary Energy Demand Energy Conservation by Solar Electricity:		kBTU/(ft²yr)		
Heating Load:	3.48	BTU/(ft²hr)		
Frequency of Overheating:		%	over 77.0 °F	
Specific Useful Cooling Energy Demand:	0.00	kBTU/(ft²yr)	4.75 kBTU/(ft²yr)	No
Cooling Load:	0.00	BTU/(ft²hr)		

Transmission Losses	Heat Gains Solar Radiation
kBTU/yr	kBTU/yr
0	0
2470	921
8301	17645
4221	2878
0	0
14992	21443

We confirm that the values given herein have been determined following the PHPP methodology and based on the characteristic values of the building. The calculations with PHPP are attached to this application.

Issued on:

signed:

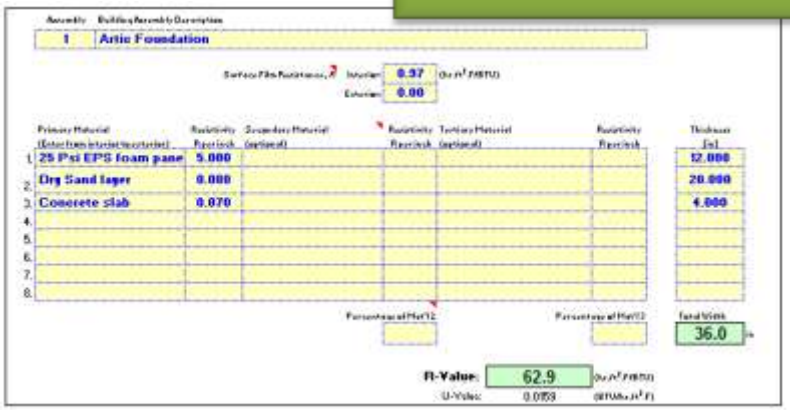
Building: Chlupp Residence

Annual Heat Demand: 4.29 kBTU/(ft²yr)

Climate: Fairbanks, Alaska

Window Area Orientation	Global Radiation (Cardinal Points)	Shading	Dirt	Non-Perpendicular Incident Radiation	Glazing Fraction	SHGC	Reduction Factor for Solar Radiation	Window Area	Window U-Value	Window R-Value	Glazing Area	Glazing Area as % of Gross Floor Area	Average Global Radiation
maximum:	kBTU/ft²yr	0.75	0.95	0.85				ft²	BTU/hr.ft².F	hr.ft².F/BTU	ft²		kBTU/ft²yr
North	17	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	17
East	70	0.74	0.95	0.85	0.728	0.63	0.43	48.3	0.18	5.7	35.2	2.7%	70
South	174	0.97	0.95	0.85	0.850	0.63	0.66	242.1	0.12	8.4	205.8	15.9%	174
West	87	0.76	0.95	0.85	0.808	0.63	0.50	105.9	0.14	7.3	85.6	6.6%	87
Horizontal	93	0.75	0.95	0.85	0.000	0.00	0.00	0.0	0.00	0.0	0.0	0.0%	93
Total or Average Value for All Windows						0.63	0.59	396.3	0.13	7.6	326.6		

The SunRise Home



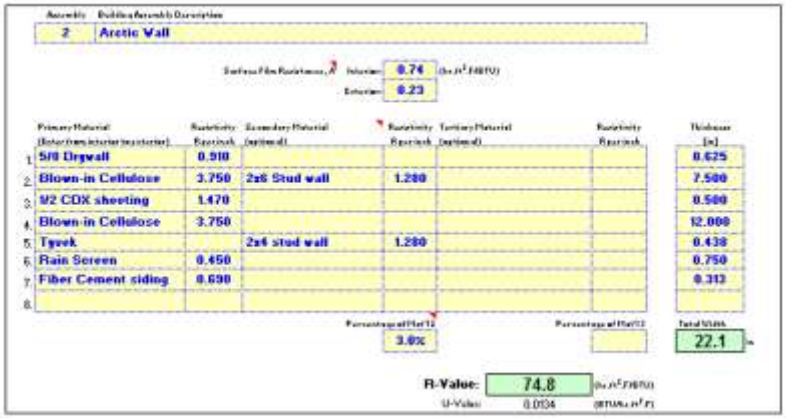
	Assembly	Building Assembly Description
	1	Artic Foundation

Surface Film Resistance: Interior 0.97 (hr·ft²·F/BTU)
Exterior 0.00

	Primary Material (Enter from interior to exterior)	Resistivity R per inch	Secondary Material (optional)	Resistivity R per inch	Tertiary Material (optional)	Resistivity R per inch	Thickness (in)
1	25 Psi EPS foam pane	5.000					12.000
2	Drg Sand layer	0.000					20.000
3	Concrete slab	0.070					4.000
4							
5							
6							
7							
8							

Percentage of Part 2: Percentage of Part 3: Total Width: 36.0 in

R-Value: 62.9 (hr·ft²·F/BTU)
U-Value: 0.0159 (BTU/hr·ft²·F)



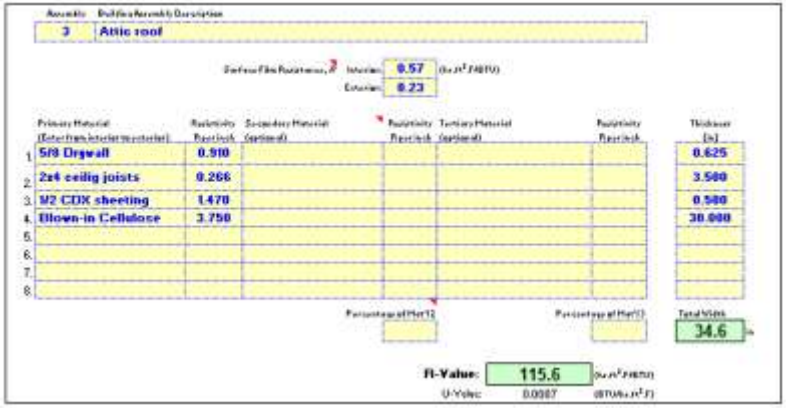
	Assembly	Building Assembly Description
	2	Arctic Wall

Surface Film Resistance: Interior 0.74 (hr·ft²·F/BTU)
Exterior 0.23

	Primary Material (Enter from interior to exterior)	Resistivity R per inch	Secondary Material (optional)	Resistivity R per inch	Tertiary Material (optional)	Resistivity R per inch	Thickness (in)
1	5/8 Drywall	0.910					0.625
2	Blown-in Cellulose	3.750	2x6 Stud wall	1.280			7.500
3	1/2 CDX sheeting	1.470					0.500
4	Blown-in Cellulose	3.750					12.000
5	Tyvek		2x4 stud wall	1.280			0.438
6	Rain Screen	0.450					0.750
7	Fiber Cement siding	0.630					0.313
8							

Percentage of Part 2: 3.0% Percentage of Part 3: Total Width: 22.1 in

R-Value: 74.8 (hr·ft²·F/BTU)
U-Value: 0.0134 (BTU/hr·ft²·F)



	Assembly	Building Assembly Description
	3	Attic roof

Surface Film Resistance: Interior 0.57 (hr·ft²·F/BTU)
Exterior 0.23

	Primary Material (Enter from interior to exterior)	Resistivity R per inch	Secondary Material (optional)	Resistivity R per inch	Tertiary Material (optional)	Resistivity R per inch	Thickness (in)
1	5/8 Drywall	0.910					0.625
2	2x4 ceilig joists	0.266					3.500
3	1/2 CDX sheeting	1.470					0.500
4	Blown-in Cellulose	3.750					30.000
5							
6							
7							
8							

Percentage of Part 2: Percentage of Part 3: Total Width: 34.6 in

R-Value: 115.6 (hr·ft²·F/BTU)
U-Value: 0.0087 (BTU/hr·ft²·F)

Insulation Values

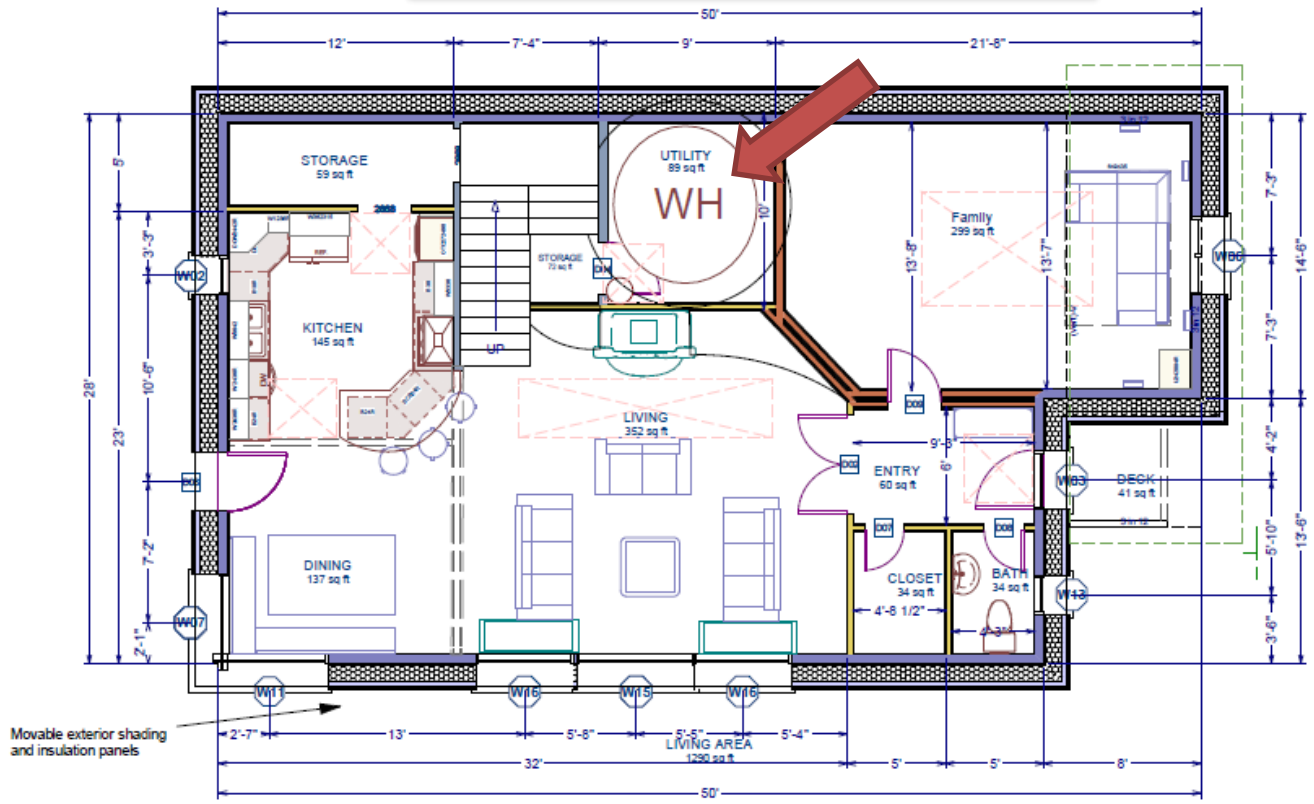
Walls R-75

Roof R-115

Slab R-63

The SunRise Home

FIRST FLOOR PLAN



WINDOW SCHEDULE

NUMBER	LABEL	QTY	FLOOR	SIZE	WIDTH	HEIGHT	R/O	EGRESS	DESCRIPTION	COMMENTS
W01	6050DC	1	2	6050DC	72 "	60 "	73"X61"		DBL CASEMENT-RHL - BIRCH (HONEY)	
W02	2046FX	1	1	2046FX	24 "	54 "	26 1/2"X56 1/2"		FIXED GLASS	
W03	3018FX	1	1	3018FX	36 "	20 "	37"X21"		FIXED GLASS - BIRCH (HONEY)	
W04	5046DC	1	2	5046DC	60 "	54 "	61"X55"		DBL CASEMENT-LHL	
W05	4020HO	1	2	4020HO	48 "	24 "	49"X25"		HOPPER - BIRCH (HONEY)	
W06	4040DC	1	1	4040DC	48 "	48 "	50 1/2"X50 1/2"		DBL CASEMENT-LHL - BIRCH (HONEY)	
W07	5050FX	1	1	5050FX	60 "	60 "	62 1/2"X62 1/2"		FIXED GLASS - BIRCH (HONEY)	
W08	5050SC	1	2	5050SC	60 "	60 "	61"X61"	YES	SNGL CASEMENT-HR - BIRCH (HONEY)	
W09	6050FX	1	2	6050FX	72 "	60 "	73"X61"		FIXED GLASS - BIRCH (HONEY)	
W10	6050DC	1	2	6050DC	72 "	60 "	74 1/2"X62 1/2"	YES	DBL CASEMENT-LHL - BIRCH (HONEY)	
W11	6050FX	1	1	6050FX	72 "	60 "	74 1/2"X62 1/2"		FIXED GLASS - BIRCH (HONEY)	
W12	3040FX	1	2	3040FX	36 "	48 "	37"X49"		FIXED GLASS	
W13	2020HO	1	1	2020HO	24 "	24 "	26 1/2"X26 1/2"		HOPPER - BIRCH (HONEY)	
W14	6075FX	1	1	6075FX	72 "	89 "	72"X90"		FIXED GLASS - BIRCH (HONEY)	
W15	6018HO	1	1	6018HO	72 "	20 "	72"X20 1/2"		HOPPER - BIRCH (HONEY)	
W16	5075FX	2	1	5075FX	60 "	89 "	60"X90"		FIXED GLASS - BIRCH (HONEY)	

All Windows to be fiberglass framed with an R-value of 7.68

Unless otherwise noted, all Exterior Doors to be Thermatru Fiberglass with R-12 Value Garage R-20

Project:
1004CH - The Chlupp Residence
2595 Allen Adale

REINA

Design by: Thorsten Chlupp

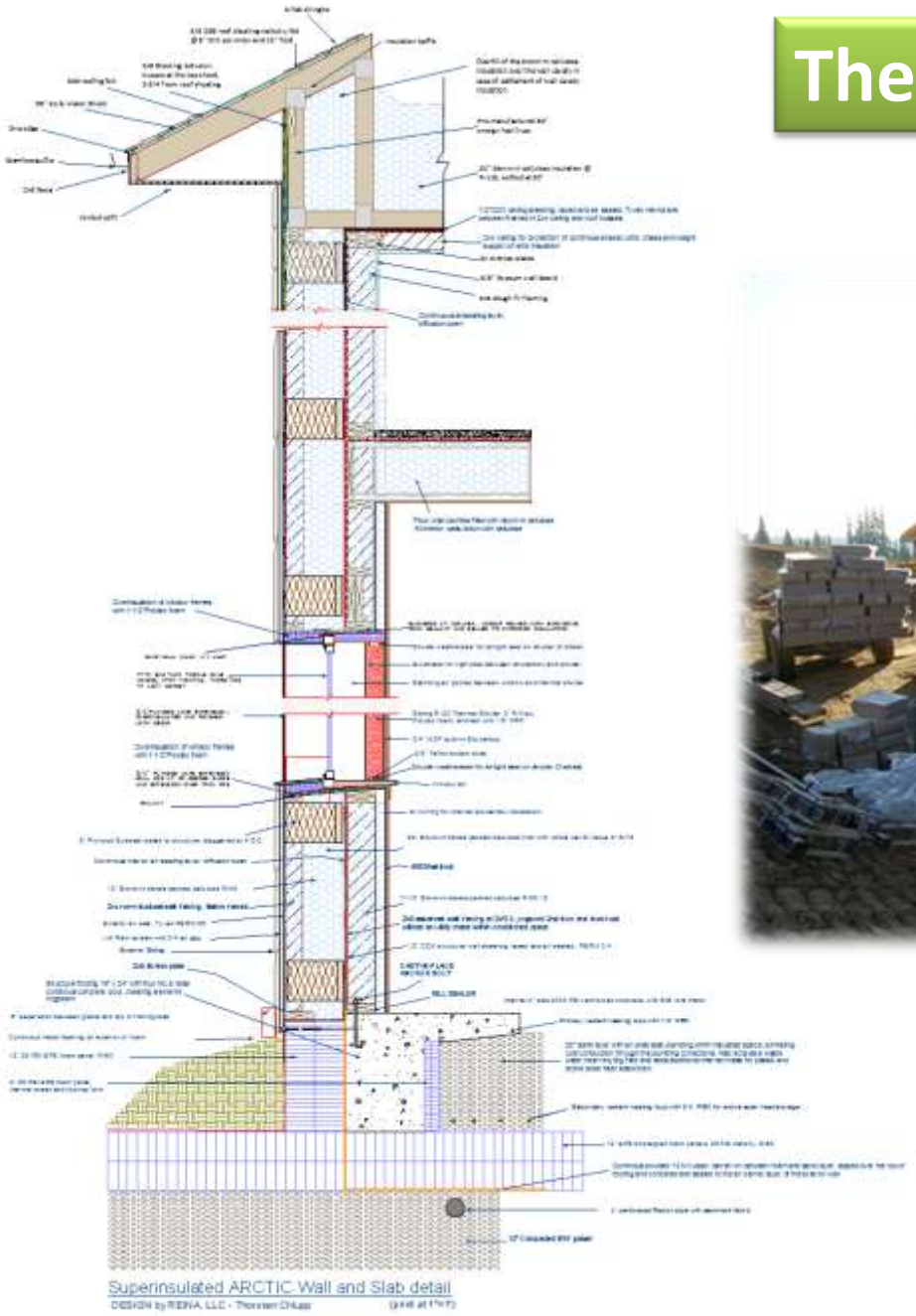
Scale: 1/4" = 1'-0"

Date: 07/24/2010

A2

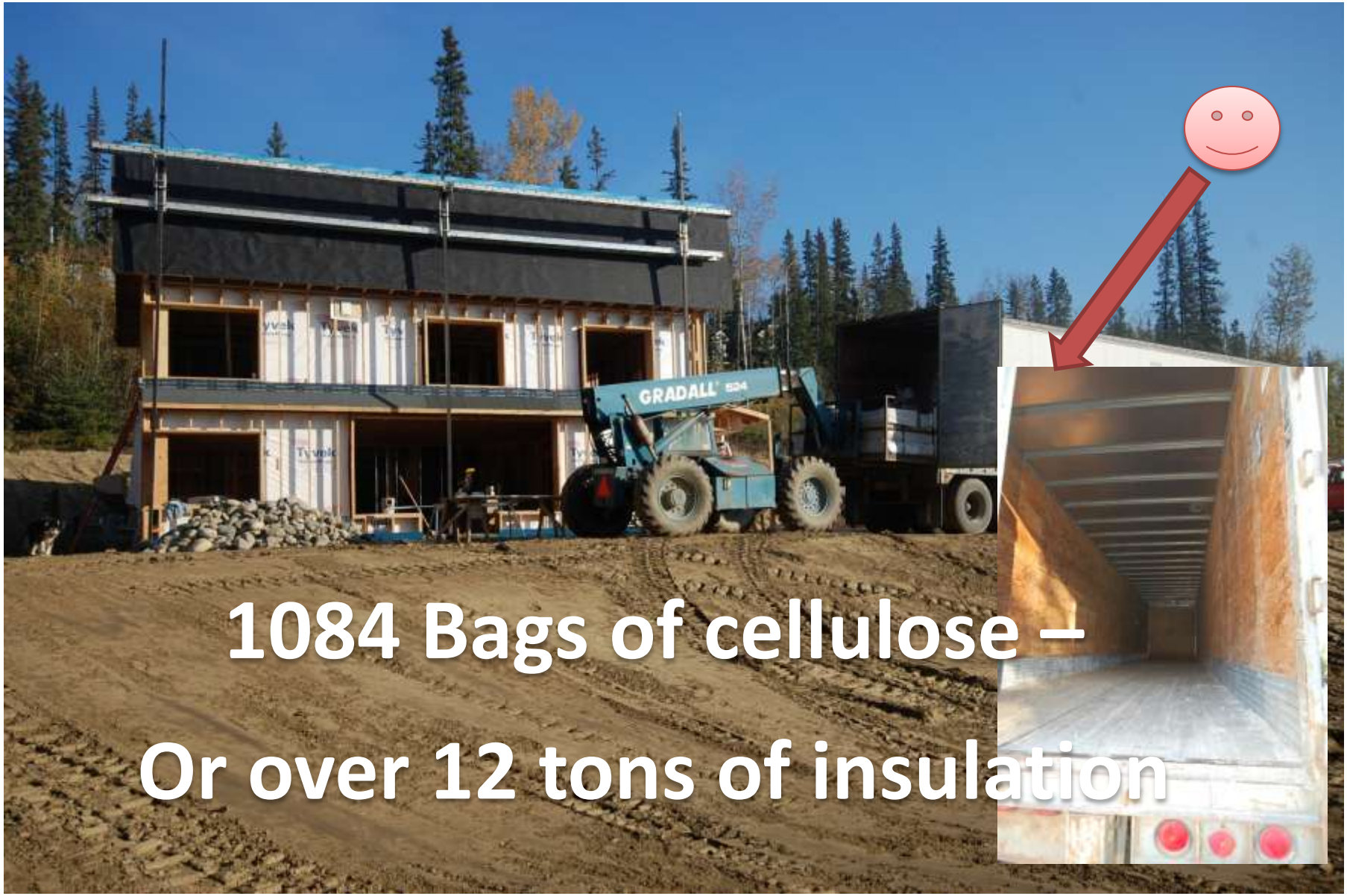
The SunRise Home

The ARTIC Wall



The SunRise Home

The SunRise Home



1084 Bags of cellulose –

Or over 12 tons of insulation

The SunRise Home

The SunRise Home

The SunRise Home

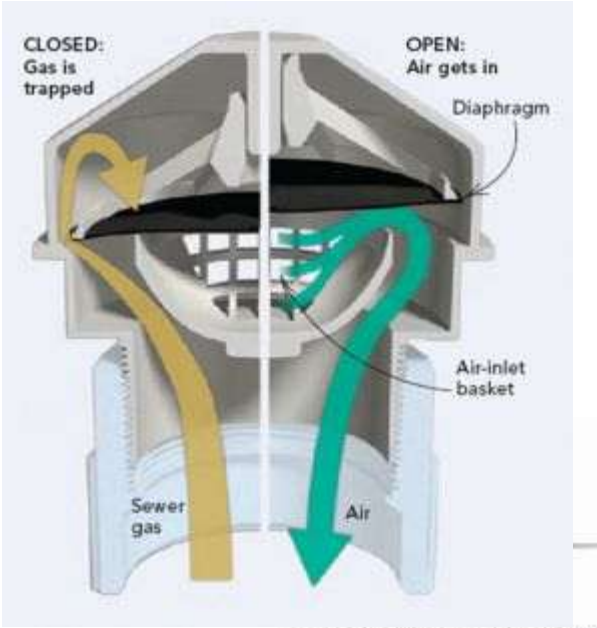
The SunRise Home

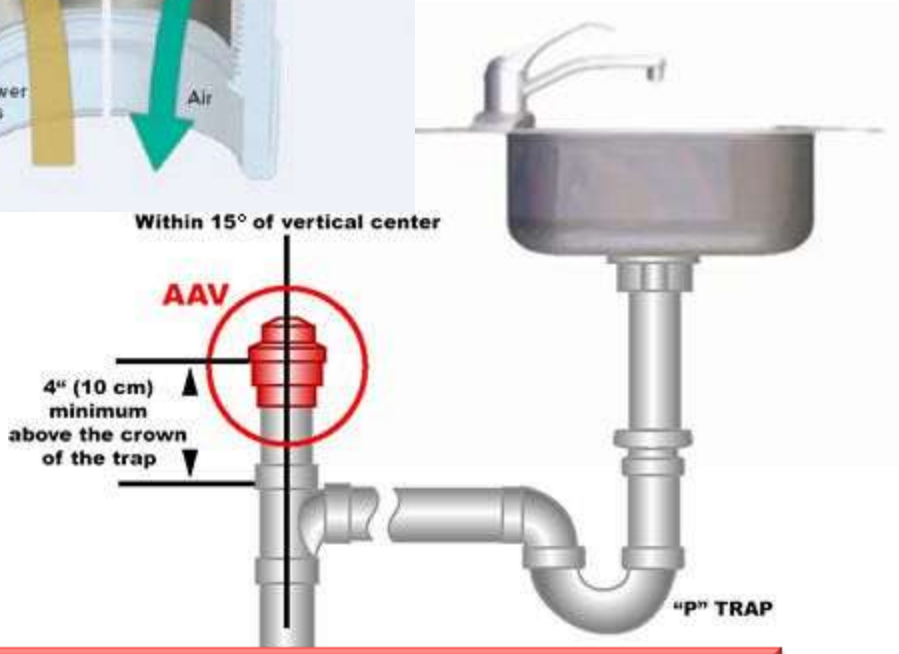
The SunRise Home


The SunRise Home

The SunRise Home

The SunRise Home





In 2009 Plumbing Code

The SunRise Home

The SunRise Home

The SunRise Home

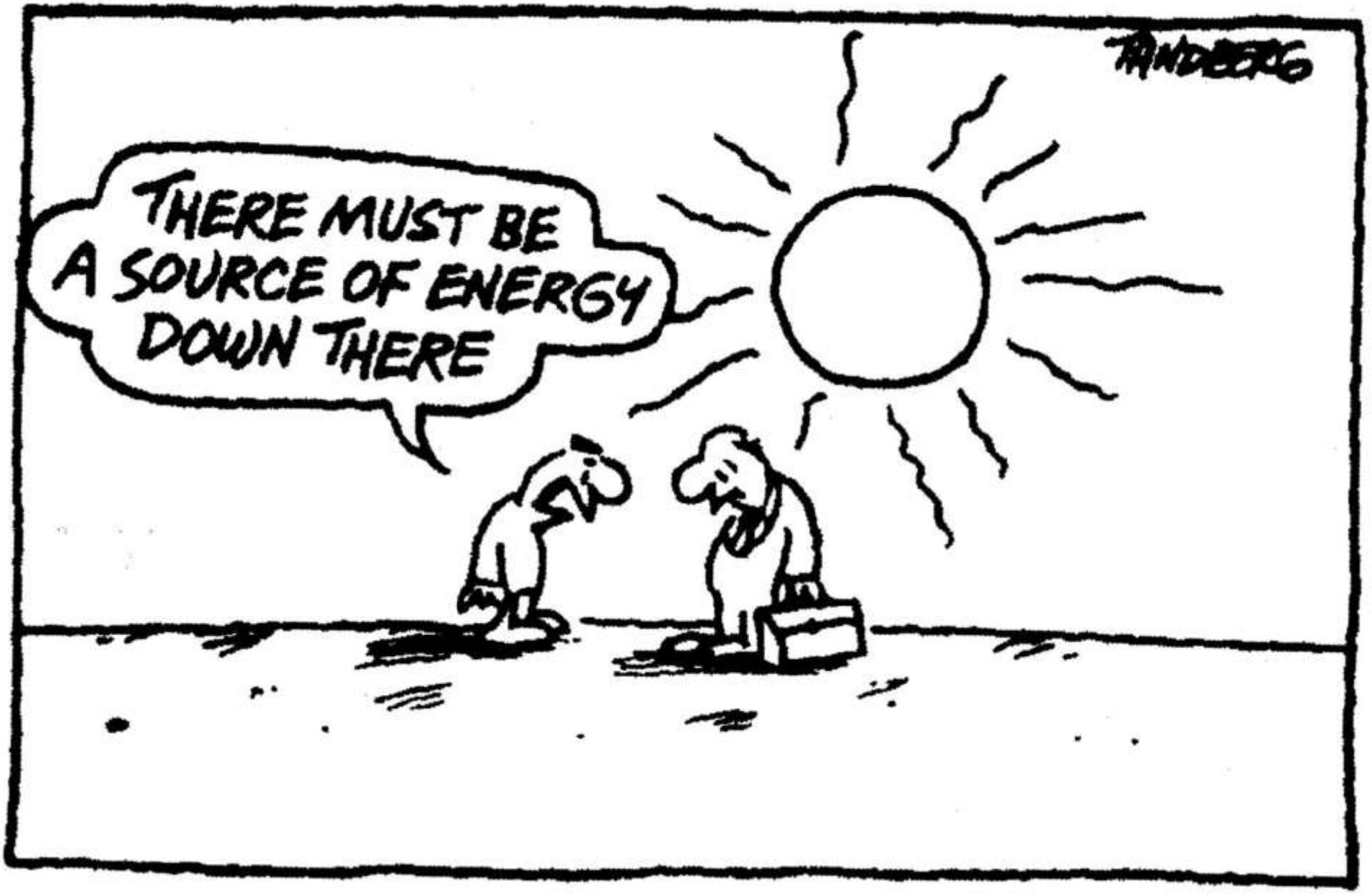
The SunRise Home

The SunRise Home

The SunRise Home

The SunRise Home

Renewable Energy System


THERE MUST BE A SOURCE OF ENERGY DOWN THERE
TRUDEAU

Welcome to the

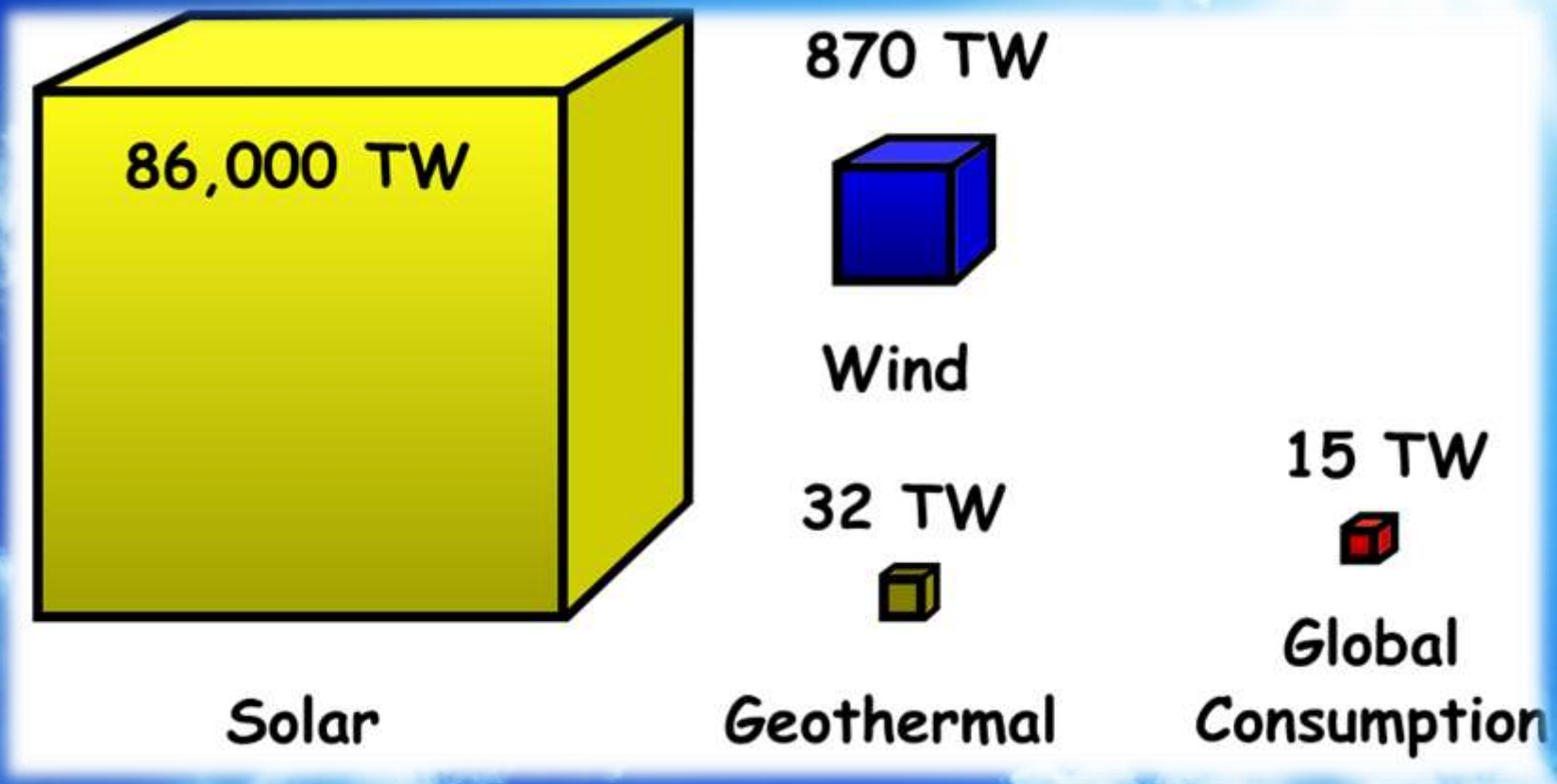
2nd Solar Age

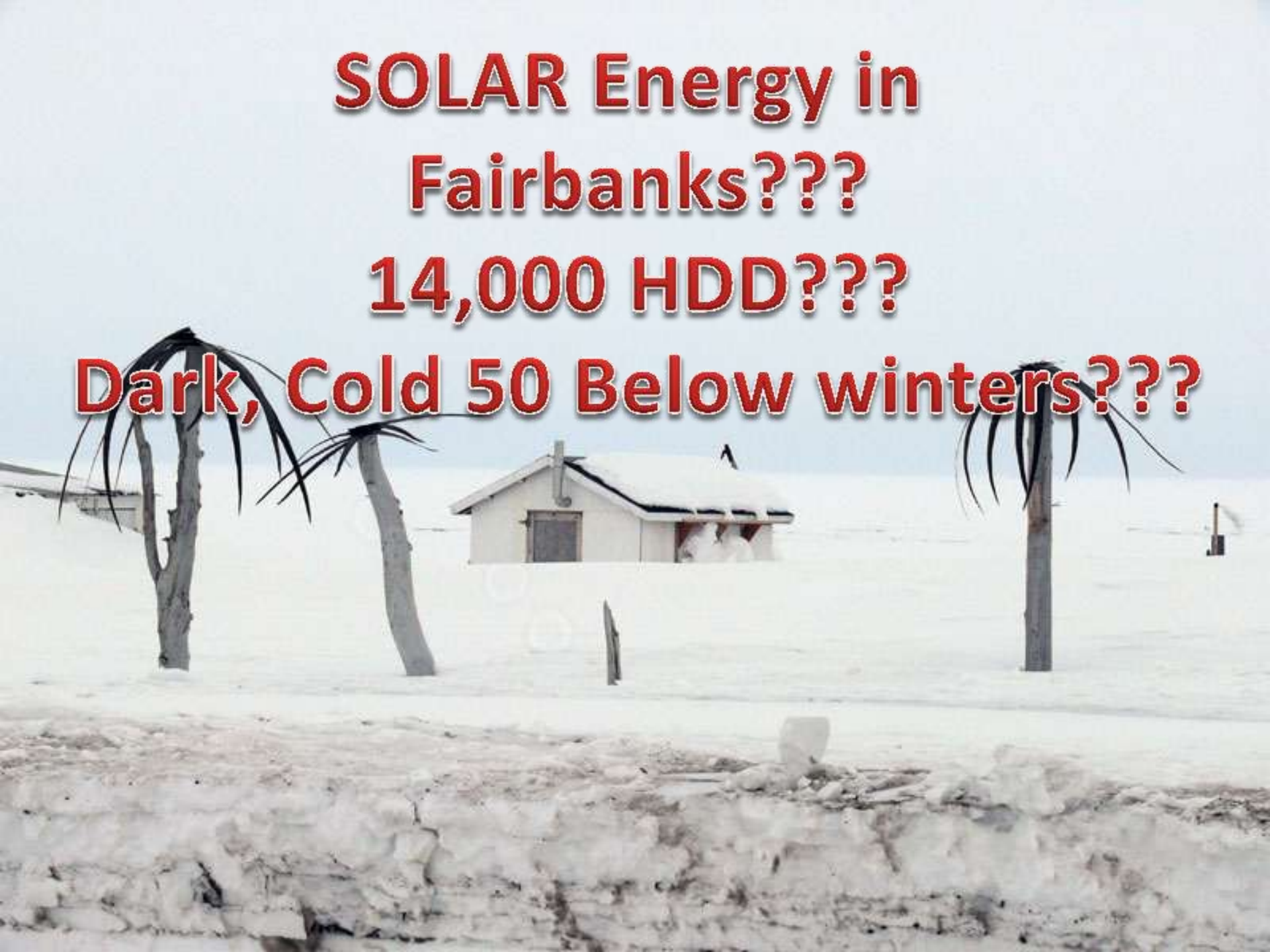
The Sun

is sending us 108,000,000,000,000,000,000 kWh

-more then 10,000 times the energy we need

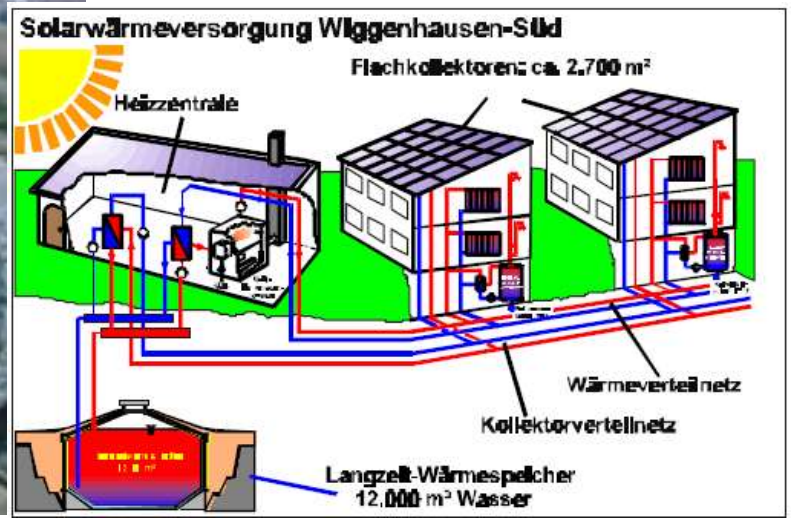
Why Solar Age?




SOLAR Energy in Fairbanks???
14,000 HDD???
Dark, Cold 50 Below winters???


GRADALL 534

Annual Seasonal Heat Storage.

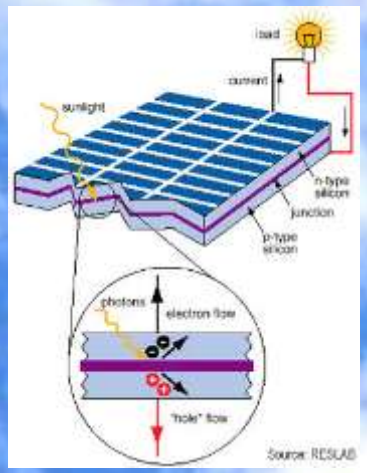


The **3,170,064 gal** hot water storage tank in Friedrichshafen, Germany supplies up to 570 living units of the newly built area since 1996.

Solar Hot Water

VS

Solar PV



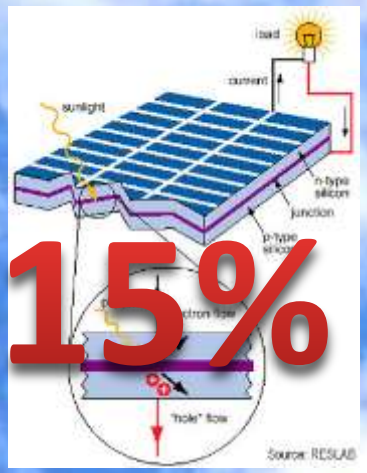
Solar Hot Water

70-85%

VS

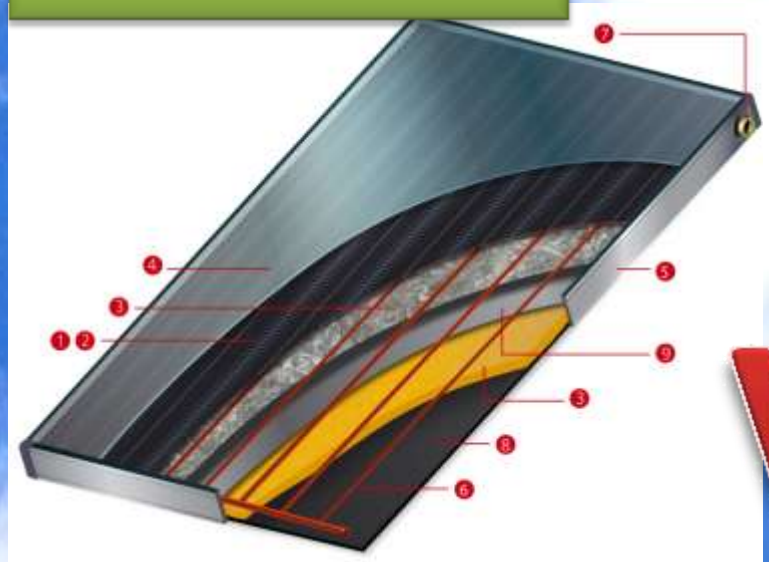
Solar PV

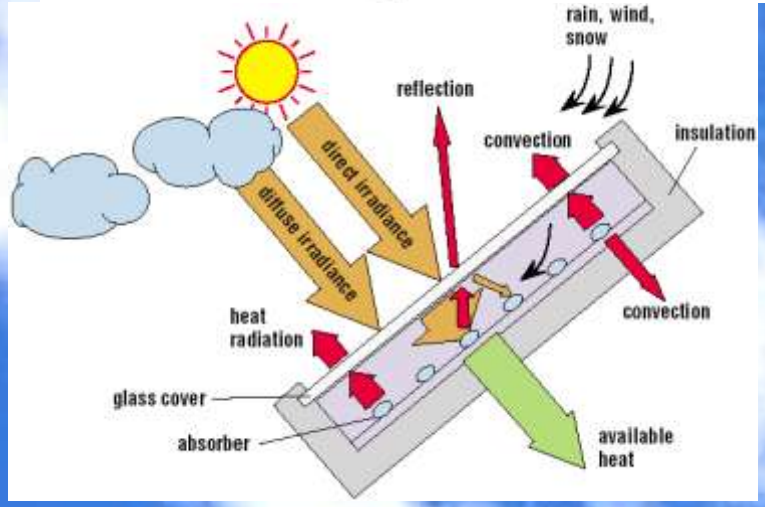
5-15%



Solar Hot Water

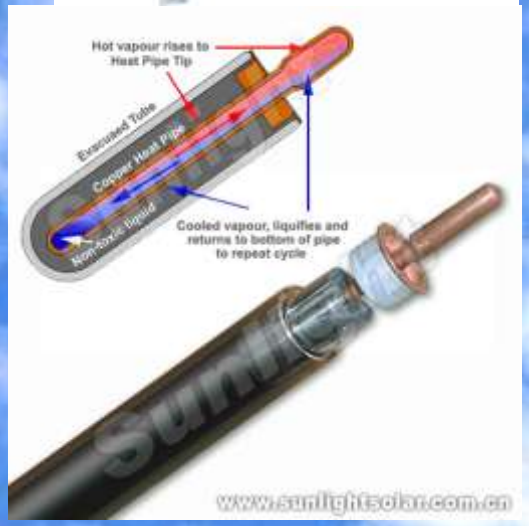
Flat Plate Collector



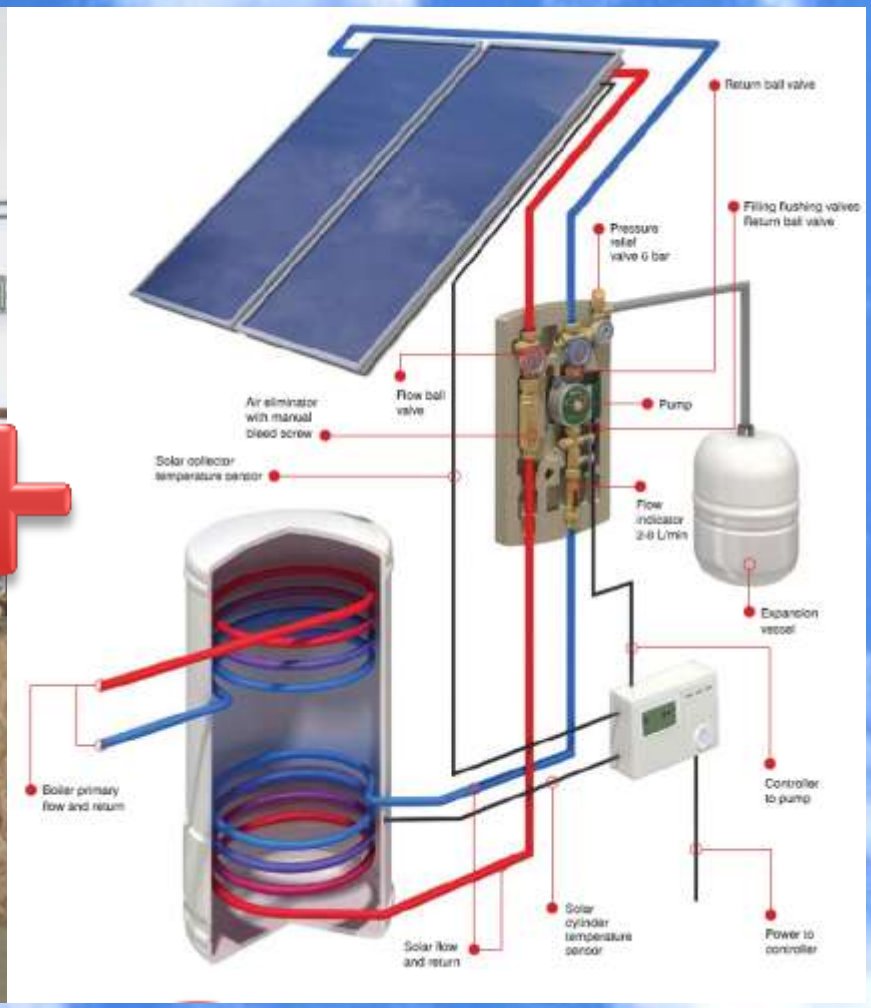


VS

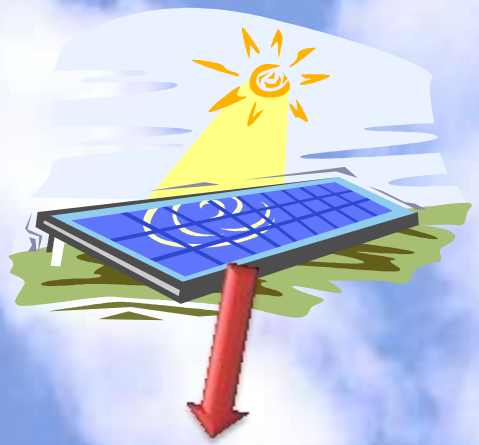
Evacuated Tube Collector



Solar Hot Water



Micro Hybrid Energy System for the Arctic



DHW buffer tank

Seasonal Storage

480 SF Thermal Collectors

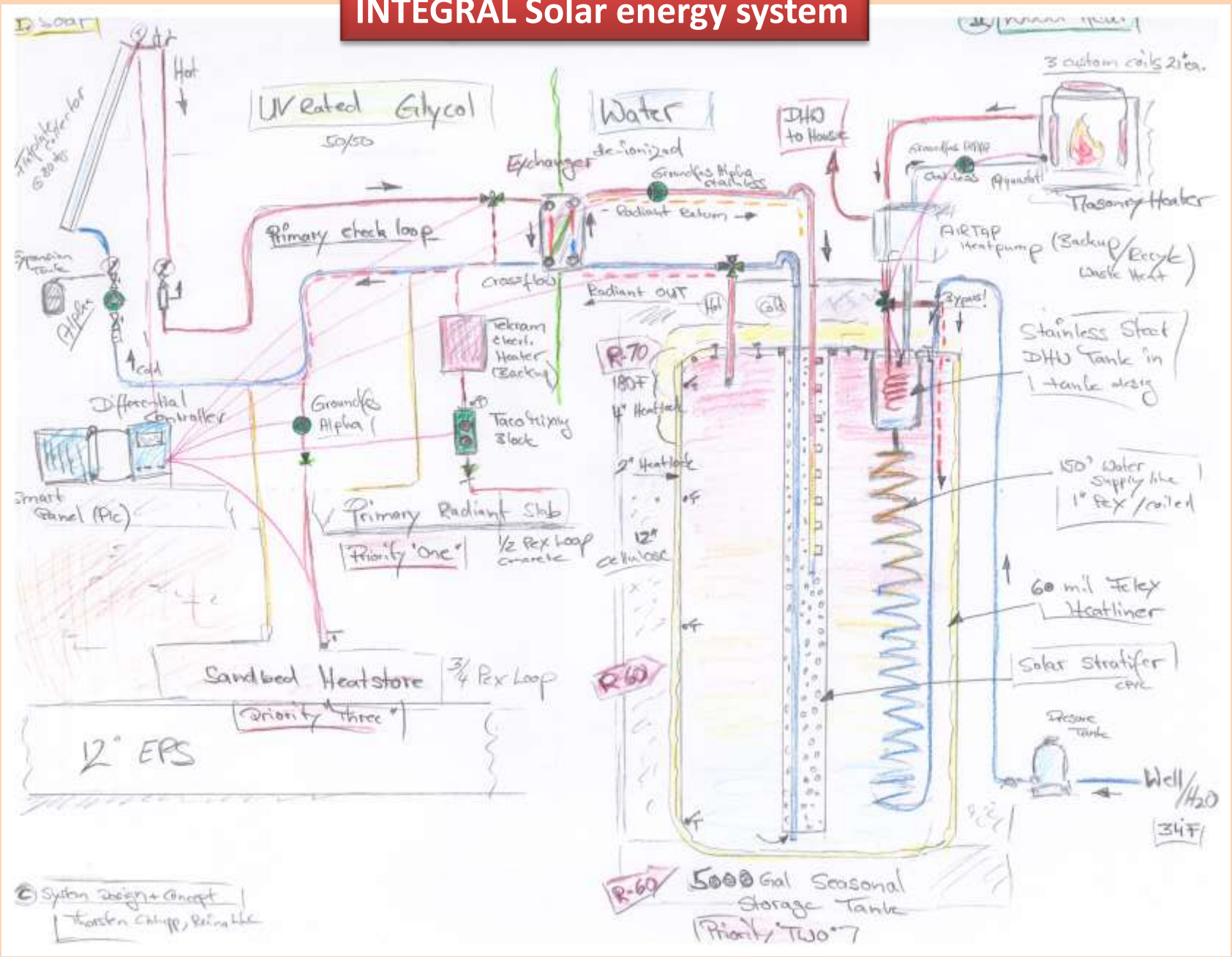
Masonry Heater

The SunRise Home

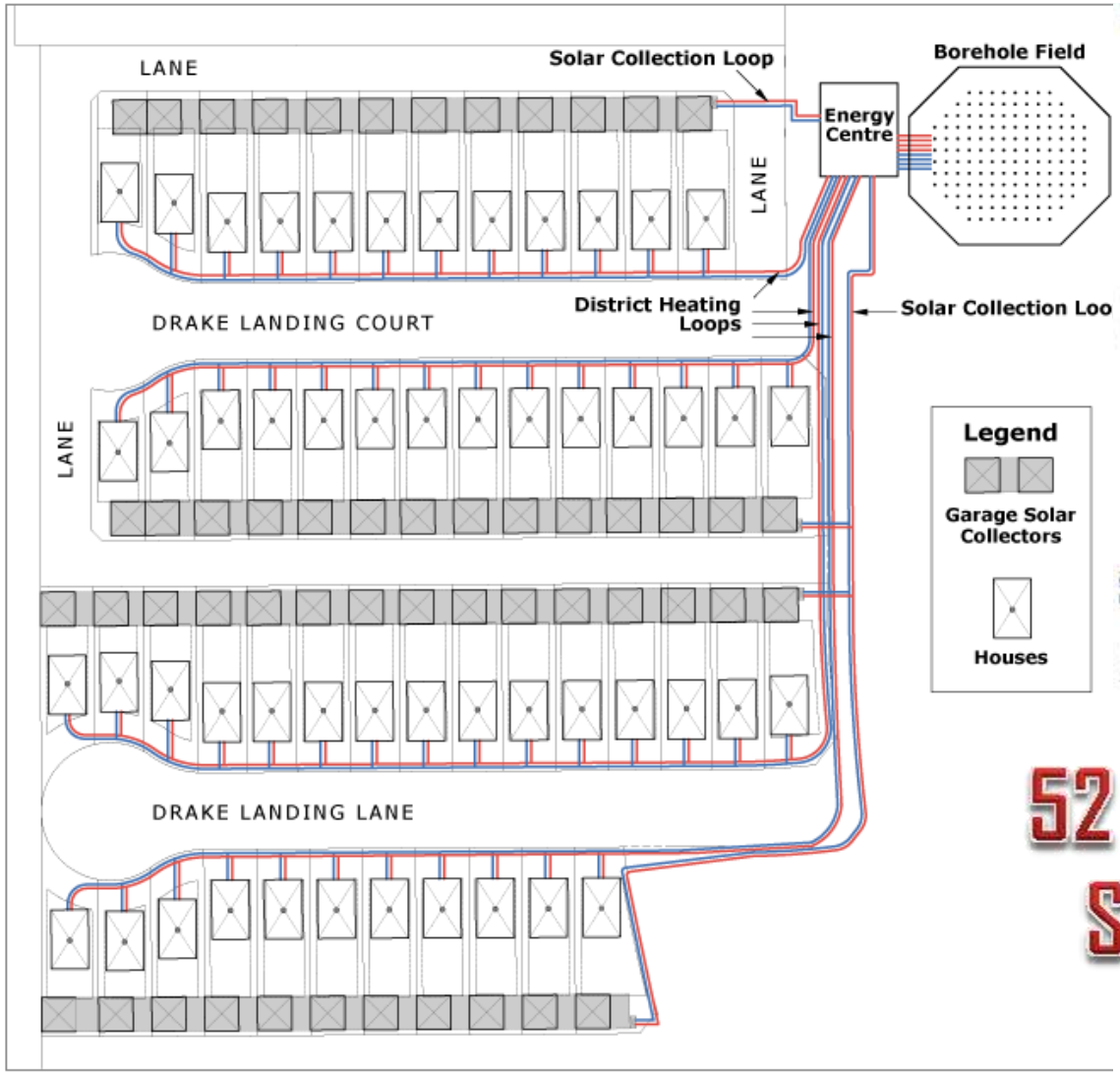
5,000 Gal Seasonal Storage Tank heated in the summer via solar heat.

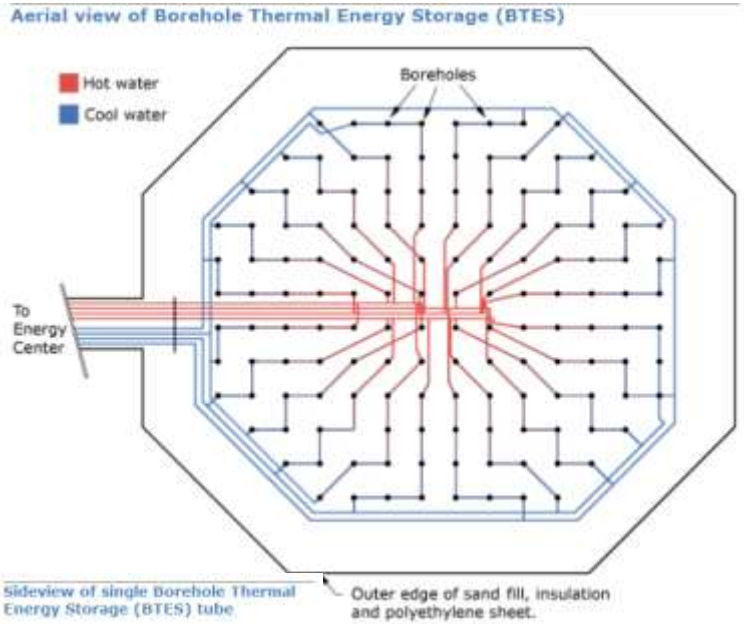
5,000 Gal Seasonal Storage

INTEGRAL Solar energy system



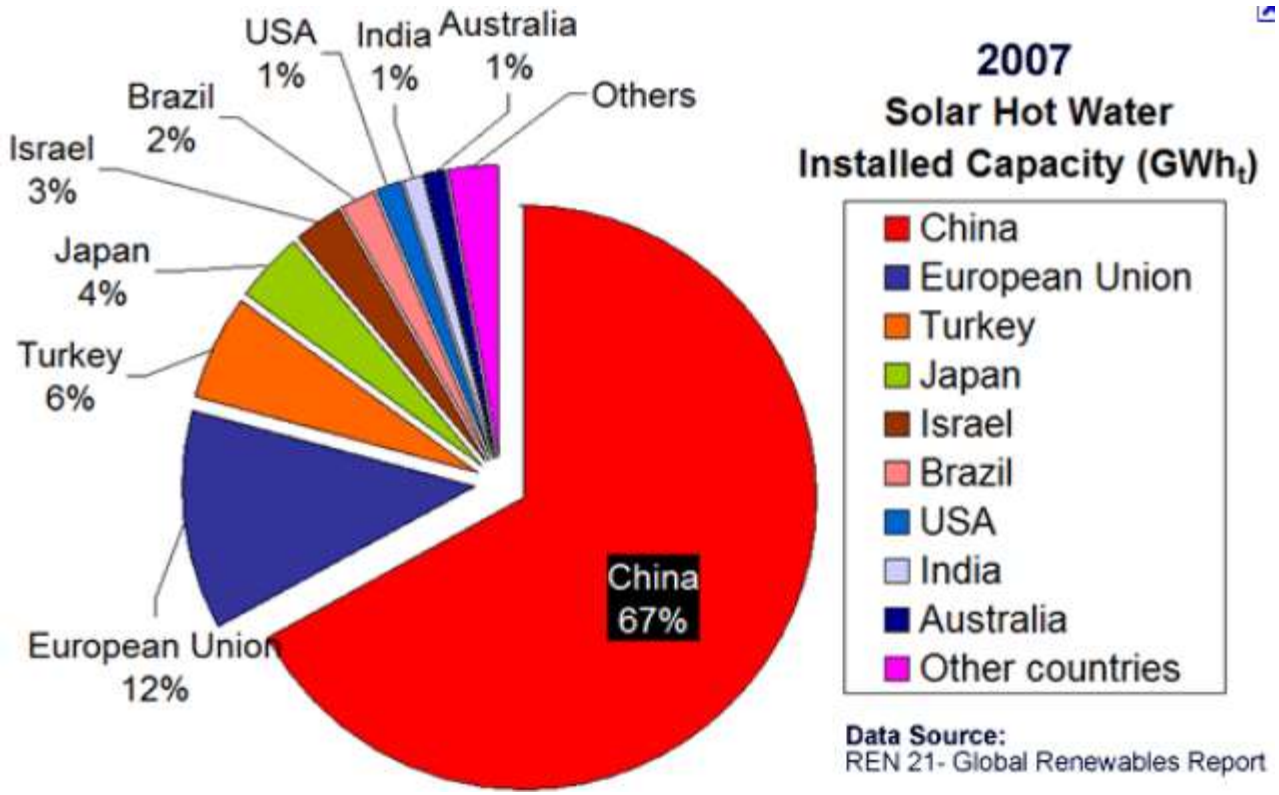
Drake Landing Solar Community





52 Homes at 90% Solar Fraction

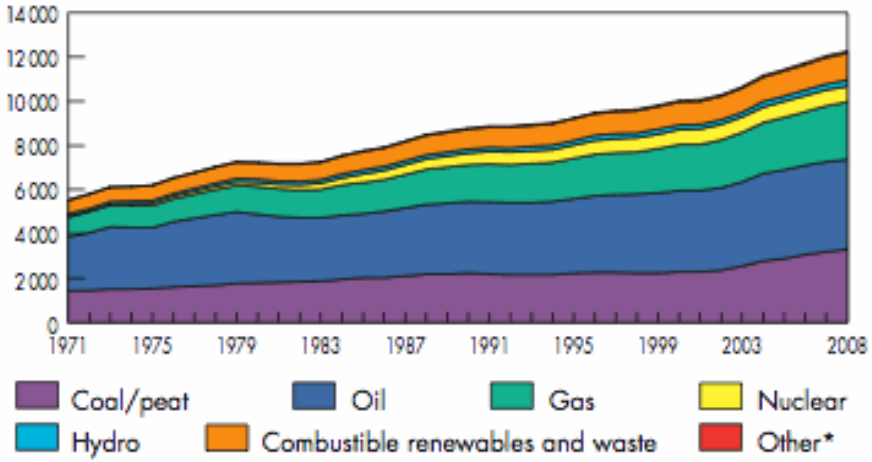
Interesting Numbers...



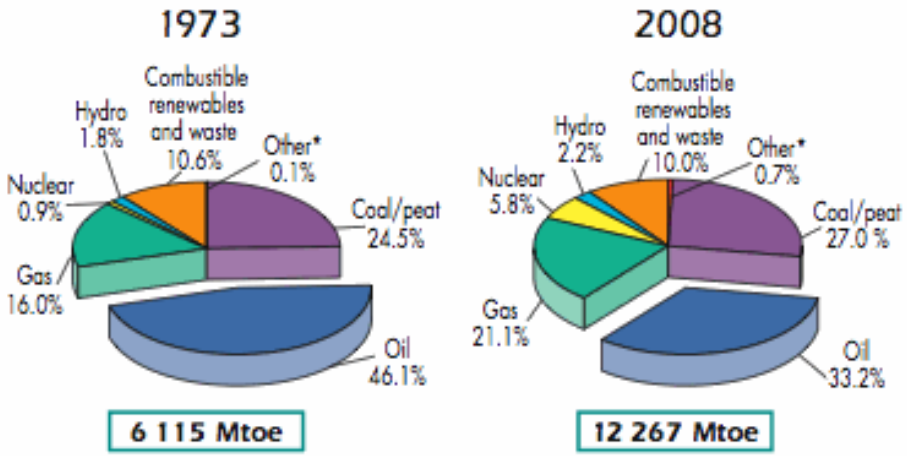
TOTAL PRIMARY ENERGY SUPPLY

World

Evolution from 1971 to 2008 of world total primary energy supply by fuel (Mtoe)

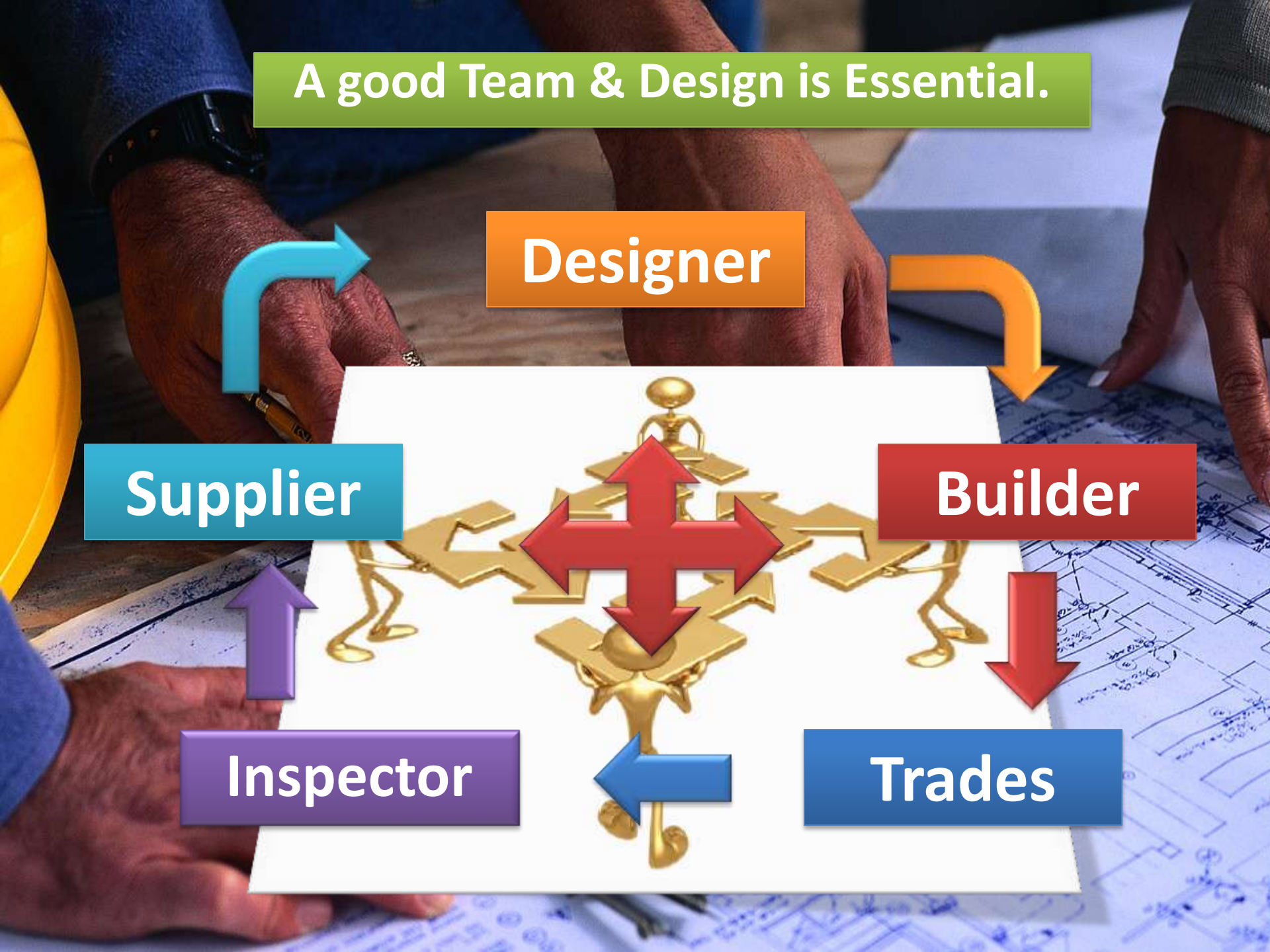


1973 and 2008 fuel shares of TPES



Key Lessons

A good Team & Design is Essential.



New tools of the Trade

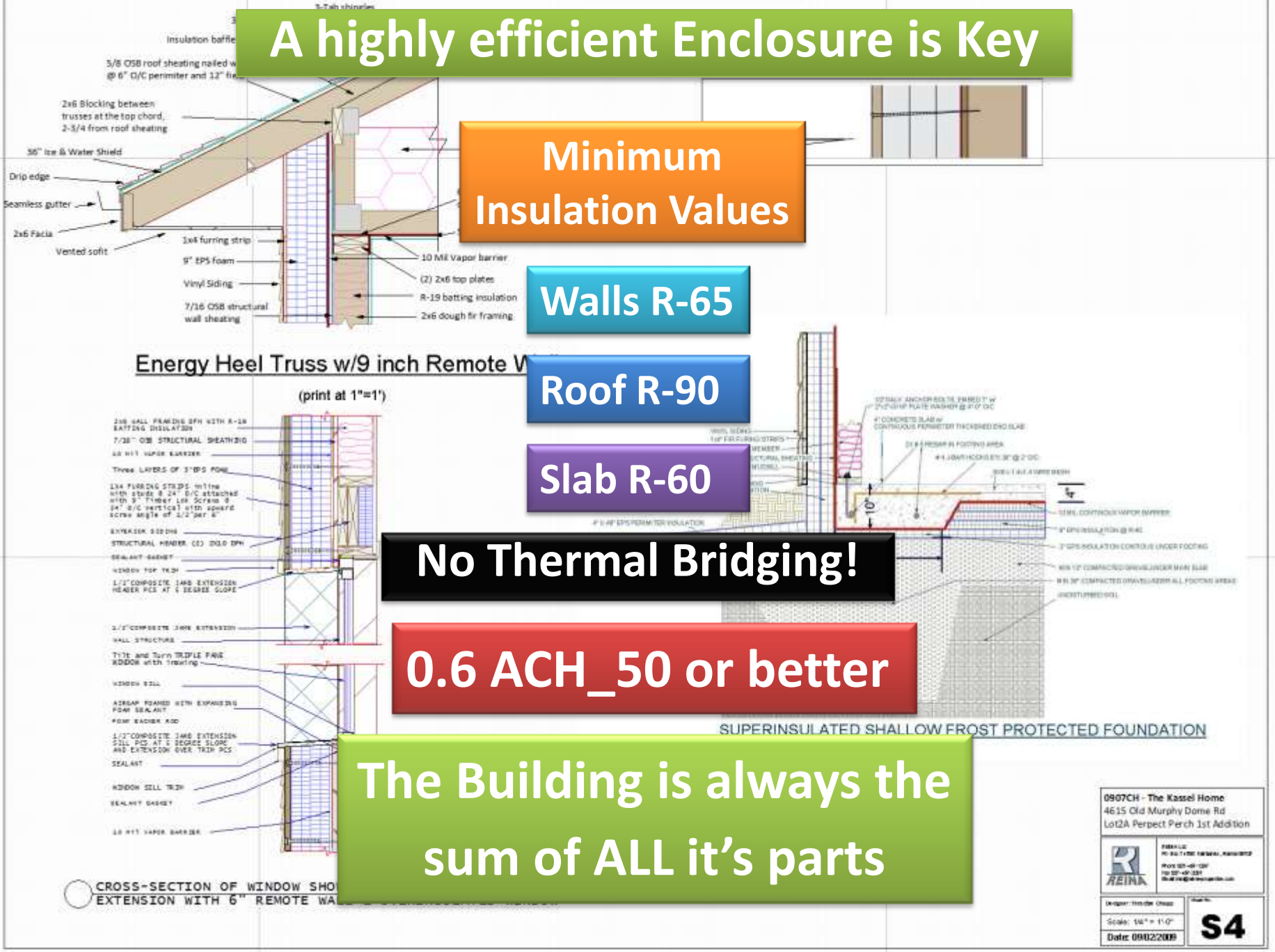
Solmetric SunEye

Blower door kit

Anemometer

IR Camera

A highly efficient Enclosure is Key



Air tightness is the cheapest and easiest measure to ensure the longevity of the core structure and conserve energy

0.6 ACH_50 made simple:

1. Design for a continuous air layer

2. Design fool proof air seal for windows and doors

3. Minimize any penetrations

4. Pre-test, Re-test and own the right tools for the job…

Windows and Doors are the weakest links in the building Assembly!

No windows due to North.

We can overcome U-values with Thermal shutters, but we depend on high SHGC

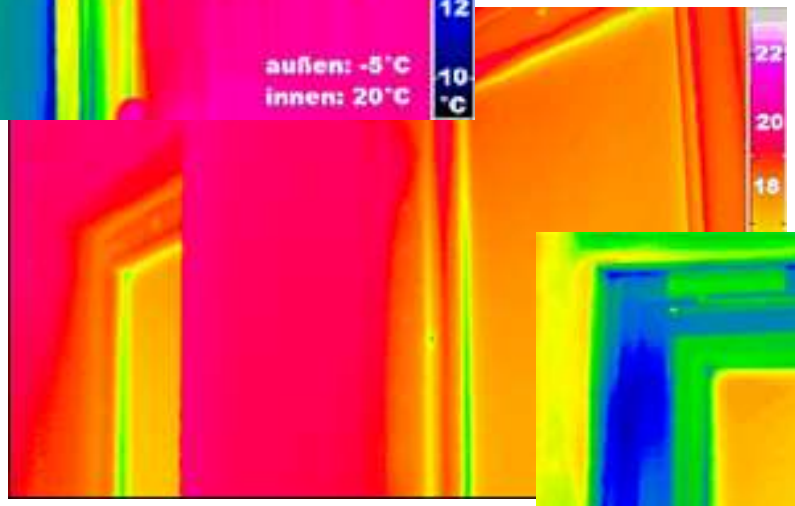
South facing glassing @ min. 60% SHGC

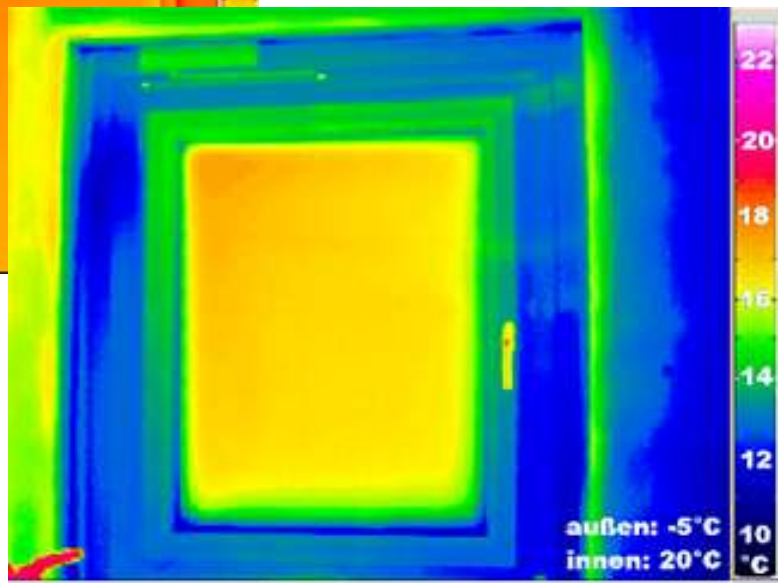
Passive Solar Gain is the only FREE energy!

Passiv Haus Windows for the Arctic

WE need – U-value of 0.072 with SHGC over 0.60

Windows – installed U-value ?





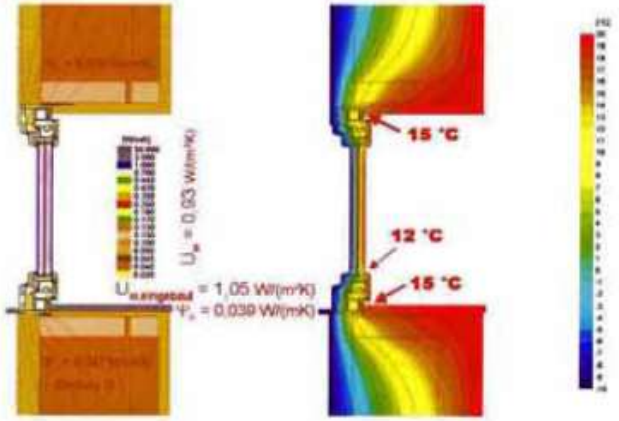
Over insulated windows Frames

= huge increase in installed – U-value

Position of Windows in the wall

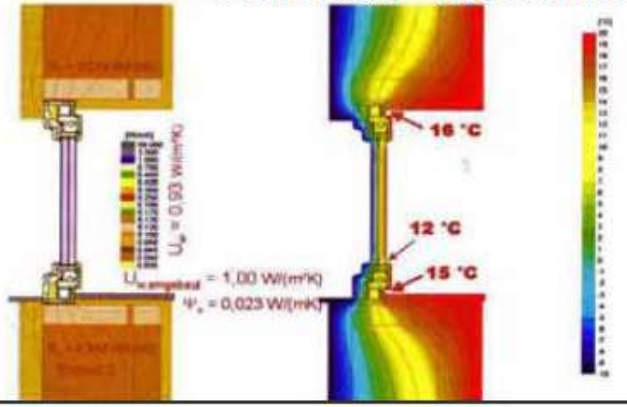
POOR: U_w(installed) = 1.05 W/m²K

Psi-install = 0.039 W/m²K



BETTER: U_w(installed) = 1.00 W/m²K

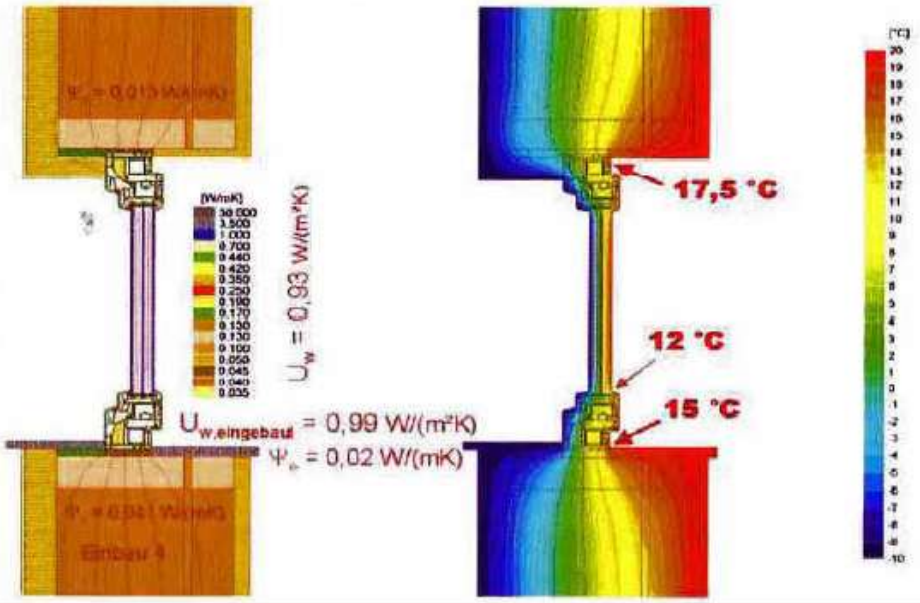
Psi-install = 0.023 W/m²K



Placing the window in the best location within the wall cavity : Horizontal direction

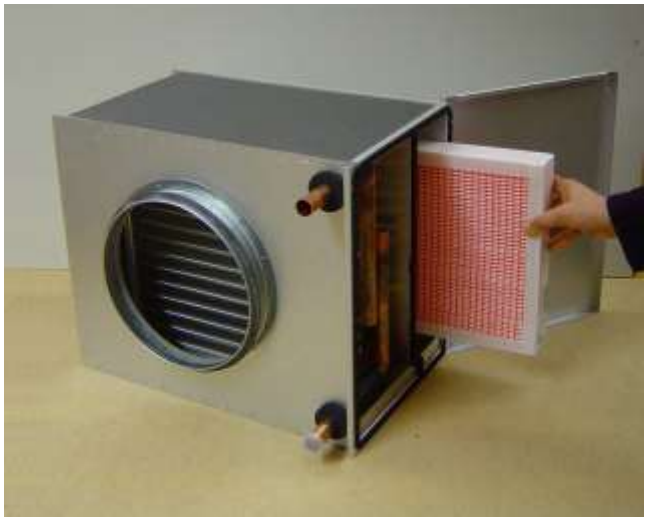
BEST: U_w(installed) = 0.99 W/m²K

Psi-install = 0.02 W/m²K



Source: Protokollbund Nr. 37, Passive House Institute, Darmstadt, Nov. 2008

Pre-warming of Air supply



Lighting

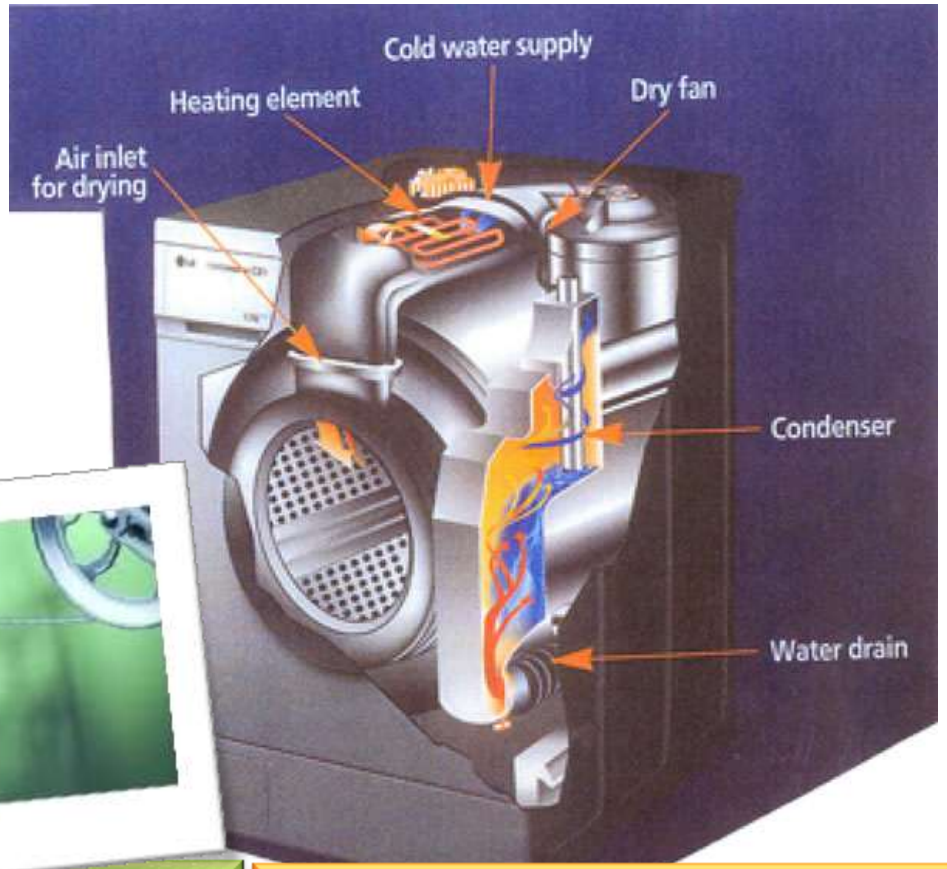
Day lighting

LED lighting

We want light – not heat…

Cloth drying

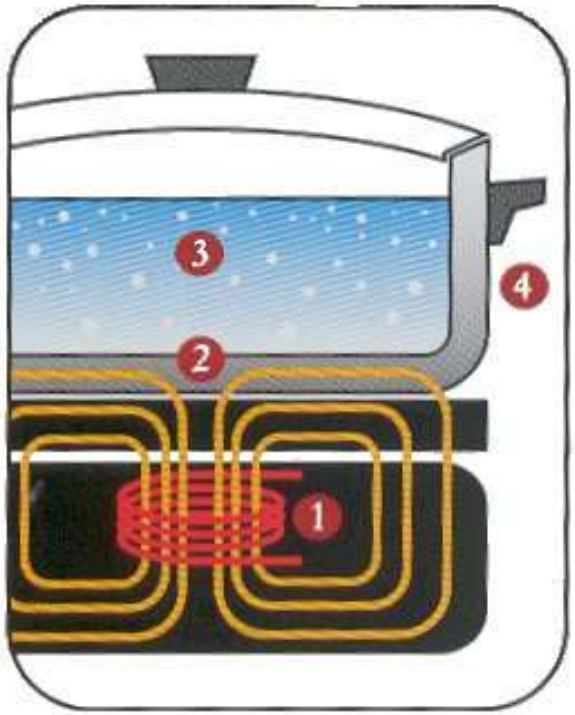
NO! Conventional Dryer, vented outside.



Cloth line is your best friend

Condensing Dryer

Induction Cooktop



Highest efficiency...

We need to re-learn the basics…

Efficiency in design

Let's keep the heat!

Size matters

What do we really need?

KISS – Keep it simple, stupid

The Sum of all its parts…

Artic Entries make sense…

True costs of Superinsulation:

Costs to Build

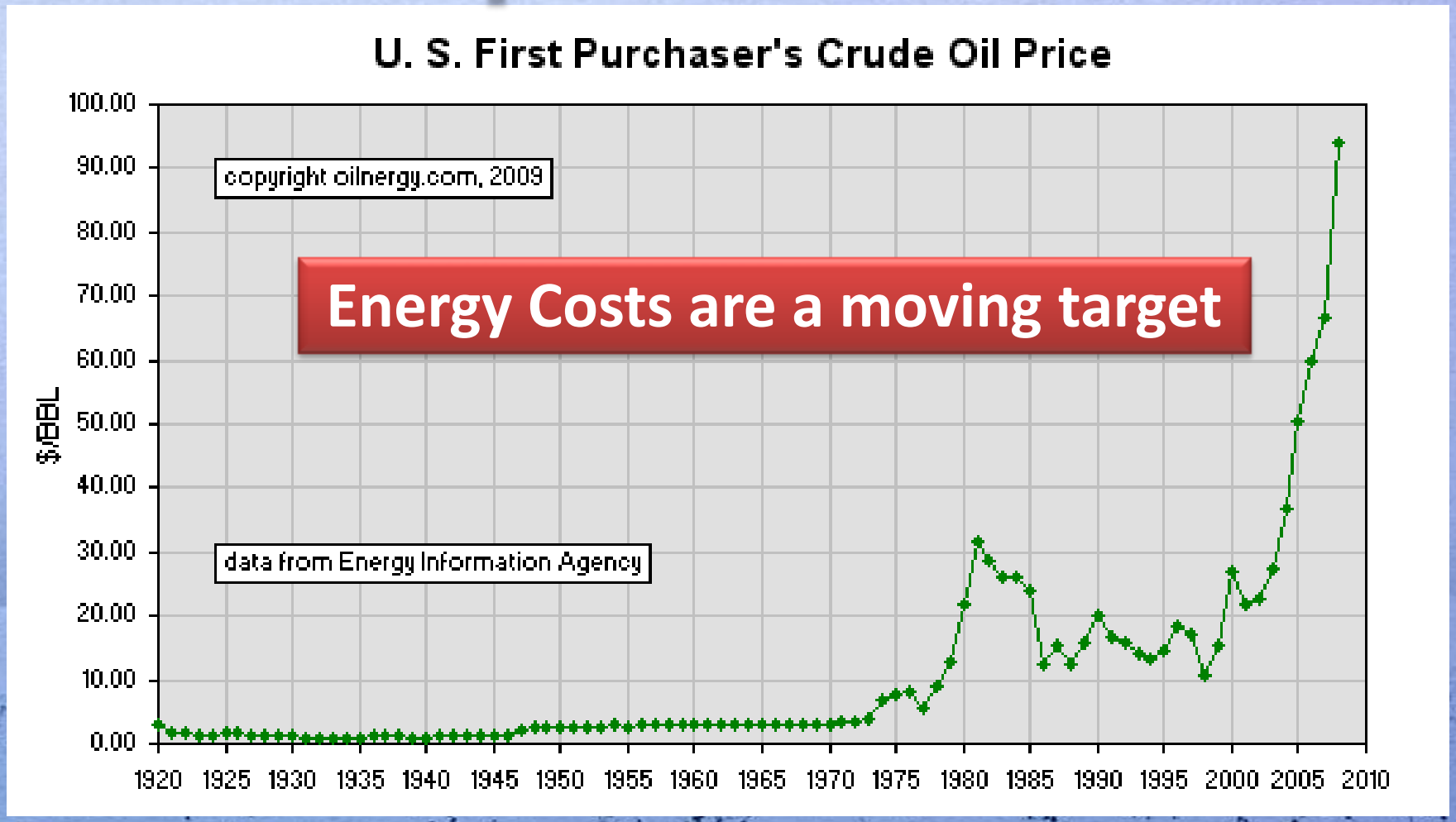
vs

Operating Costs

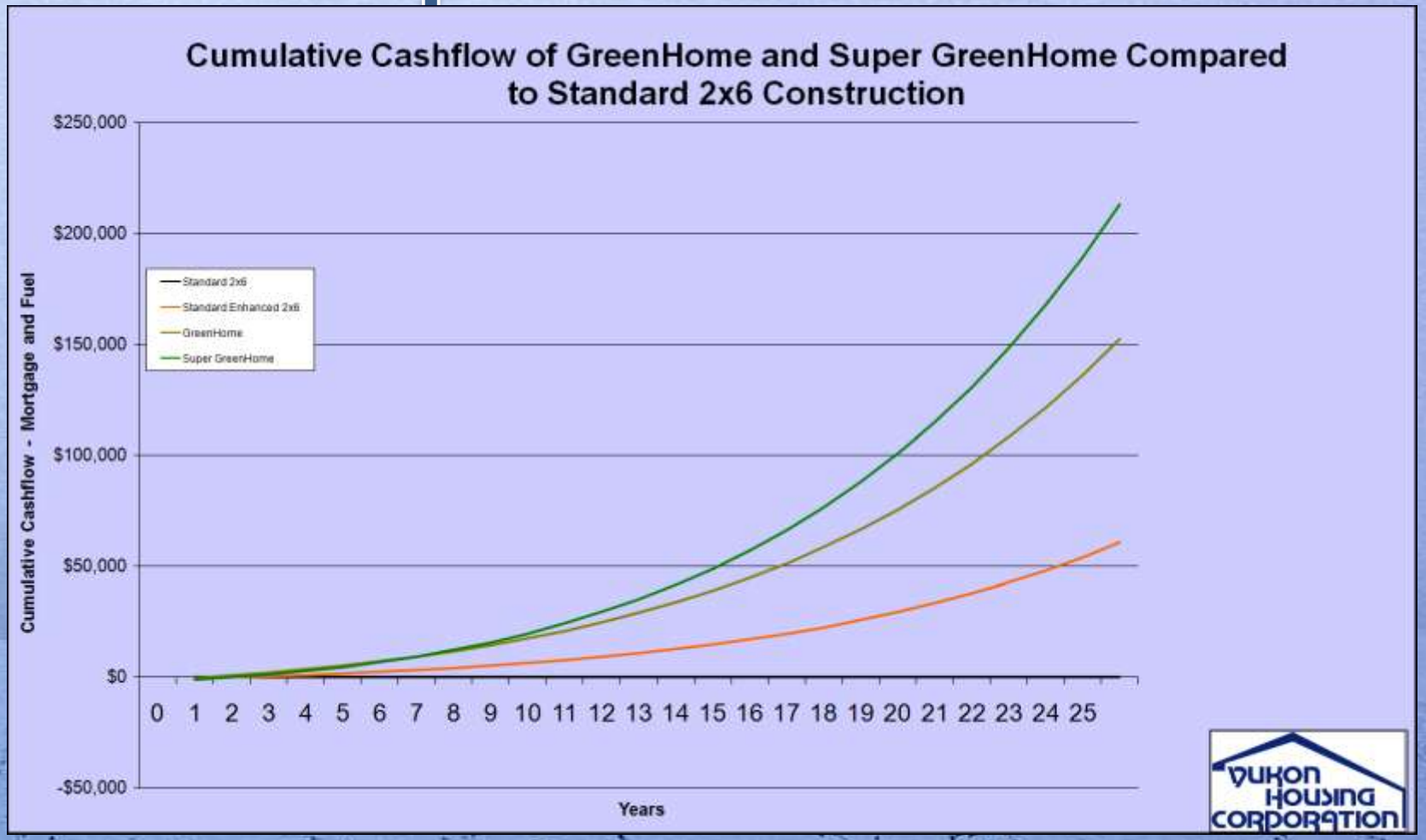
vs

Lifespan

True costs of Superinsulation:



True costs of Superinsulation:



True costs of Superinsulation:

Building super insulated makes economical sense from day ONE!

What is it going to be?

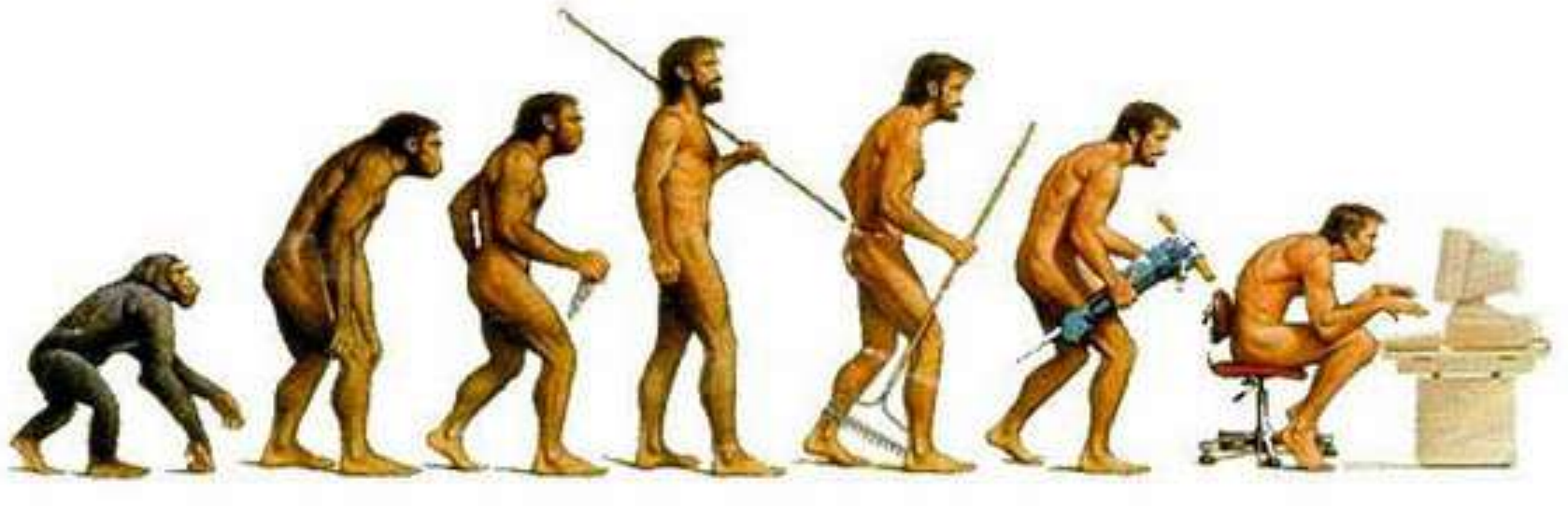
or

Opportunity

Liability

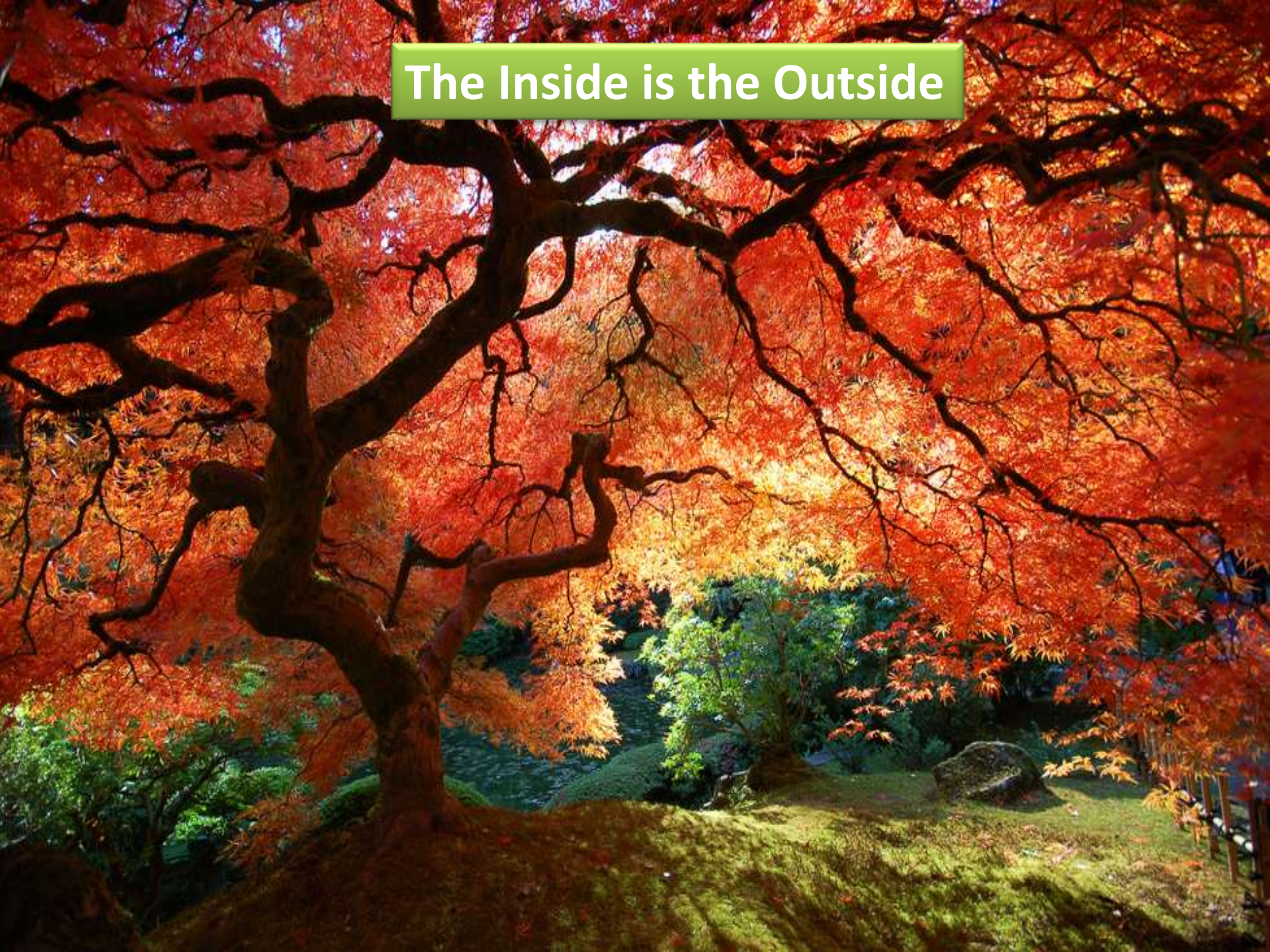
Beyond Efficiency

The Inside is the Outside




The Inside is the Outside

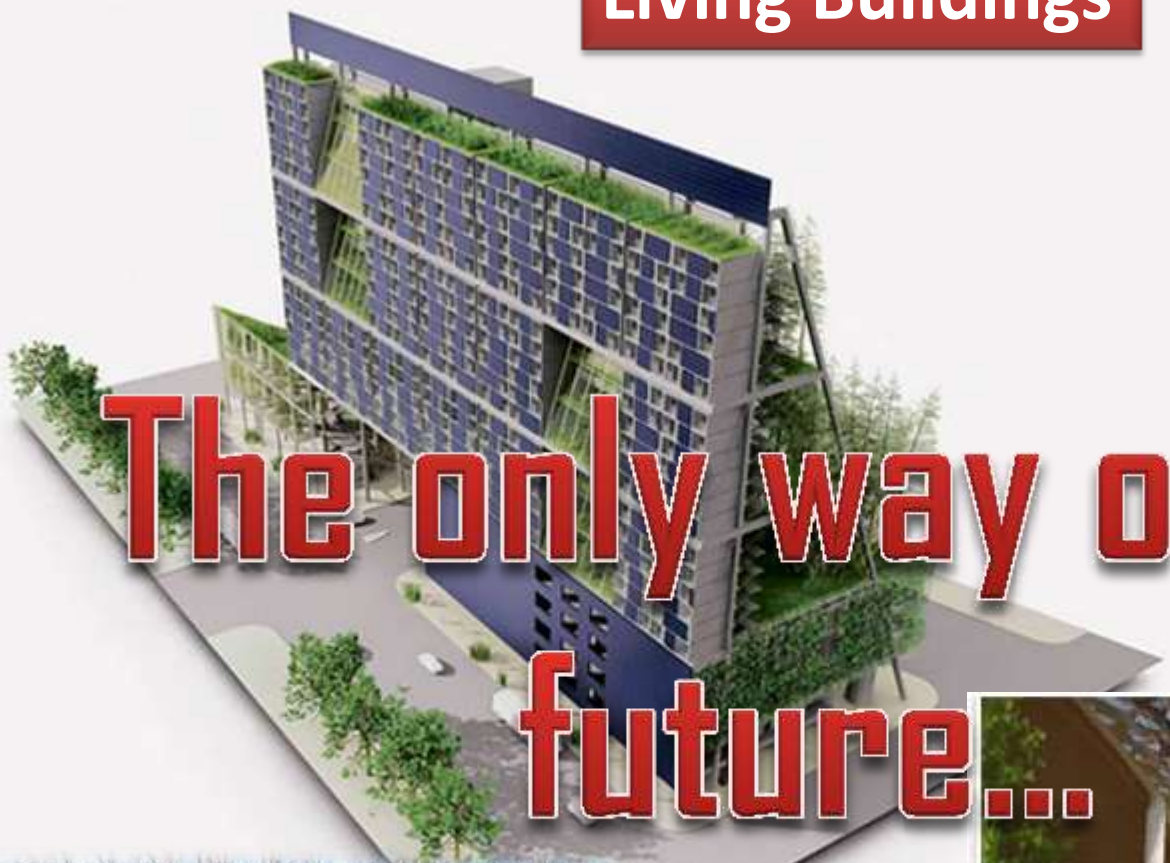
The Inside is the Outside


The Inside is the Outside

The Inside is the Outside

Living Buildings

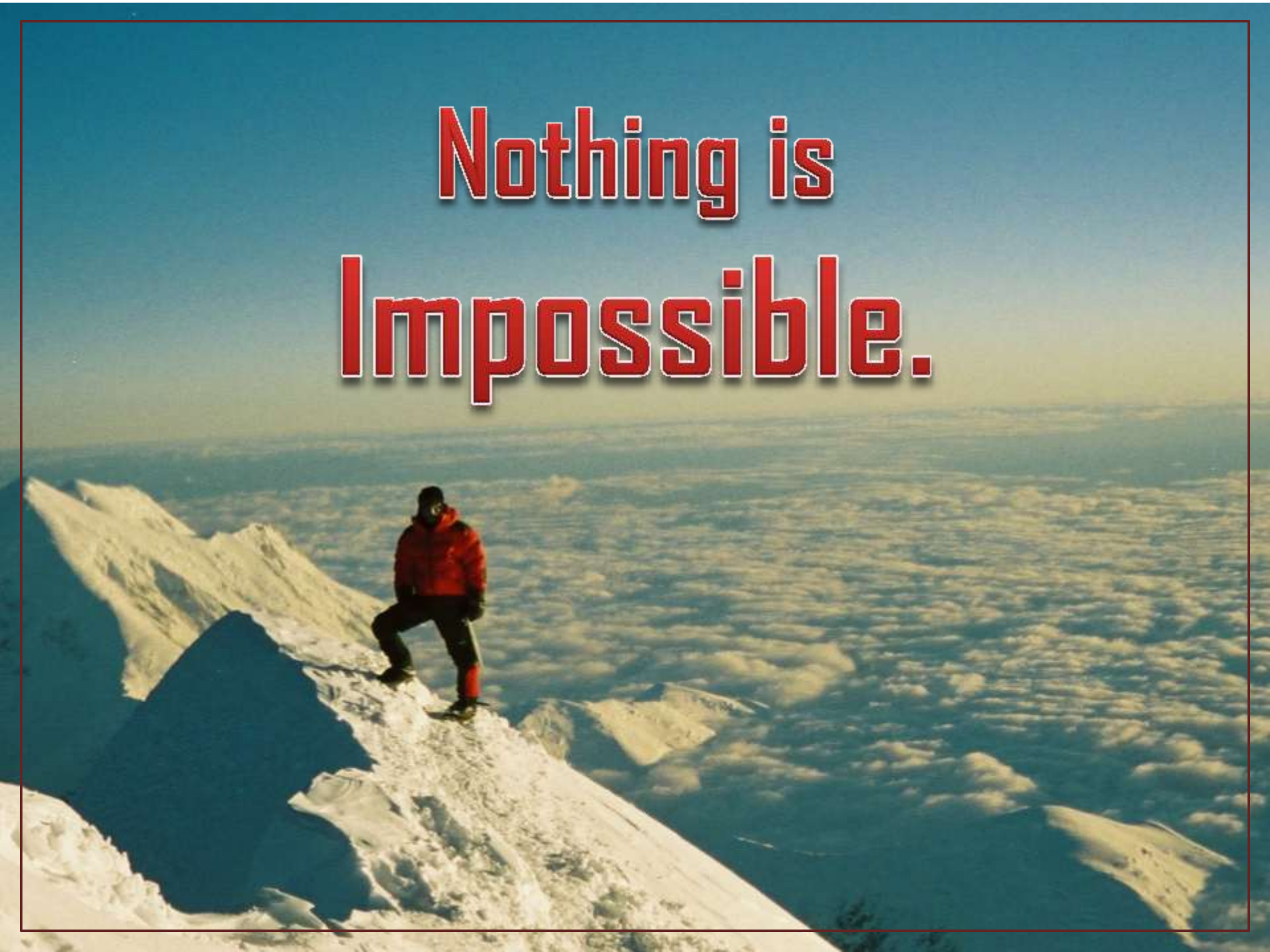
Living Buildings



The only way of the future...

Passivhaus Schools


Focus on the
Challenge.


Nothing is
Impossible.


It takes real
Effort.

Our health is priceless.


We have only one planet.


Please build
responsible!

Thank you.

QUESTIONS?

Thorsten Chlupp

COLD CLIMATE HOUSING RESEARCH CENTER

CCHRC