



Re-Building After Katrina: Smart Energy Choices

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Thoreau Was Onto Something When He Asked...



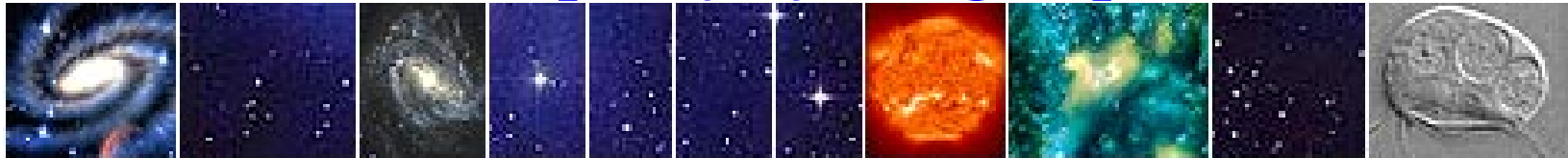
*“What’s the use
of a building if
you don’t have a
decent planet to
put it on?”*

Henry David Thoreau

Cosmic Calendar

(each month = one billion years)

Jan Feb Mar Ap M J J Aug Sep Oct Nov



Big Bang

Milky
Way
forms

Sun &
Planets

Oldest
Single
Cell

First
Multi-
Cell

We Are in December

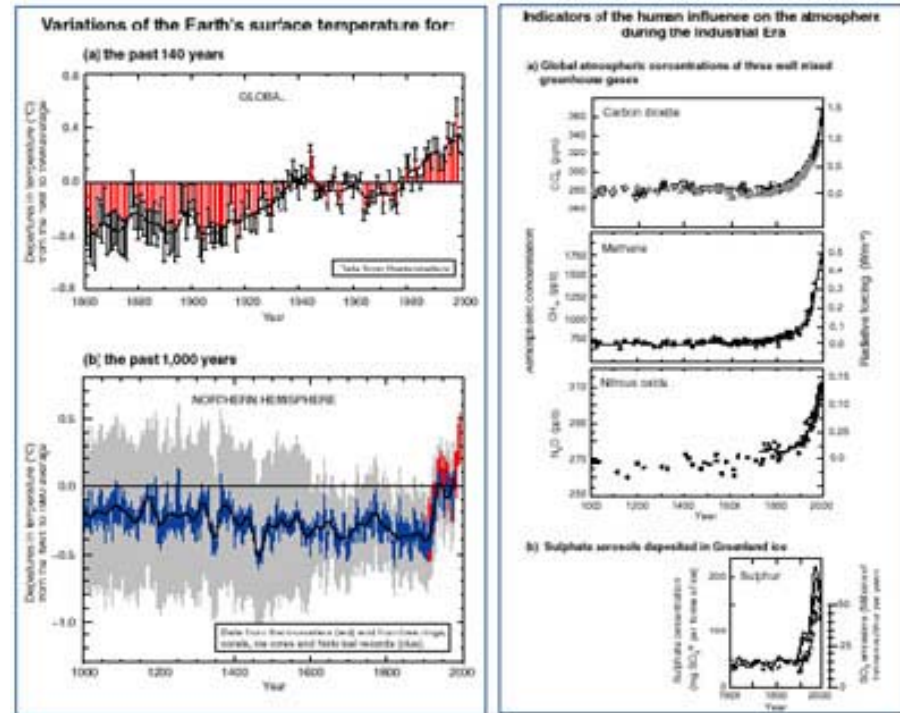
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15 Cambrian Explosion (burst of new life forms)	16	17 Emergence of first vertebrates	18 Early land plants	19	20 First four-limbed animals	21 Variety of insects begin to flourish
22	23	24 First dinosaurs appear	25 First mammalian ancestors appear	26	27 First known birds	28
29 Dinosaurs wiped out by asteroid or comet	30	31 10:15am Apes appear 9:24pm First human ancestors to walk upright 10:48pm Homo erectus appears 11:54pm Anatomically modern humans appear 11:59:45pm Invention of writing 11:59:50pm Pyramids built in Egypt 1 second before midnight: Voyage of Christopher Columbus				

What Have We Done in Our One Second?

- In the last second of the last day of the year on the Cosmic Calendar, we have made changes to our earth that many scientists conclude are irreparable.

Changes We Have Made to Our Planet

- Today's air contains **400 times more chlorine** than the air of 100 years ago...since the advent of air conditioning
- Earth's global mean temperature is estimated to be **half a degree Celsius warmer** than it was a century ago
- At the present rate of building in some countries, **every green space** will be covered in our lifetimes (For example, from 1985 to 1997, the US population grew 16% while the area of land developed grew 47%. In addition, the average single-family home size has increased more than 700 square feet since 1970).



What is Our Future Climate?

- “In 20 years, we could see a destabilization of the monsoon. In 50 years, a permanent el Nino. And in a few hundred years, we will have the collapse of the ice sheets.”

(John Schellnhuber, Potsdam Institute for Climate Impact Research, Germany)

What is Our Current Energy Climate?

- **Growing energy crisis:** crude oil prices have risen 64% in the past year, cost per kWh rising from 7 cents to 17 cents this summer
- **Capacity concerns:** the Southeast will account for 30% of projected total power demand by 2025
- **Rising consumer energy bills:** In low-income and manufactured homes, utility bills can be higher than mortgage costs in some Southeast states
- In one study, **20%** of all mobile homes sold in 2004 were repossessed

Before Katrina Hit...

Pre-Katrina Challenges

Housing challenges:

- **Local codes** for single family housing as old as 1975

Economic challenges:

- **Household average income** < \$33,000
- **19%** living at or below **the poverty line**
- **40%** of the working-age population **unemployed**
- **Electricity prices** rose 3.3% in 2005
- **Natural gas prices** rose 26% in 2005

-
- *“The typical Mississippi family spends \$1,300 annually on their homes’ utility bills. Home energy costs are often the second-highest expense, after the mortgage payment.”* (Mississippi Development Authority)

Hurricane Katrina Strikes the Gulf Coast Region

On August 29, **Category 4 hurricane** made landfall near Buras, Louisiana, with 145 mph winds

By 9:00 am parts of New Orleans were already **flooding**

Within 24 hours, key levees were breached and major flooding throughout the city

In Gulf Coast, **extensive devastation throughout 3 states, 1.5 million** without power, **2.2 million people** had registered for aid from FEMA by October 2005

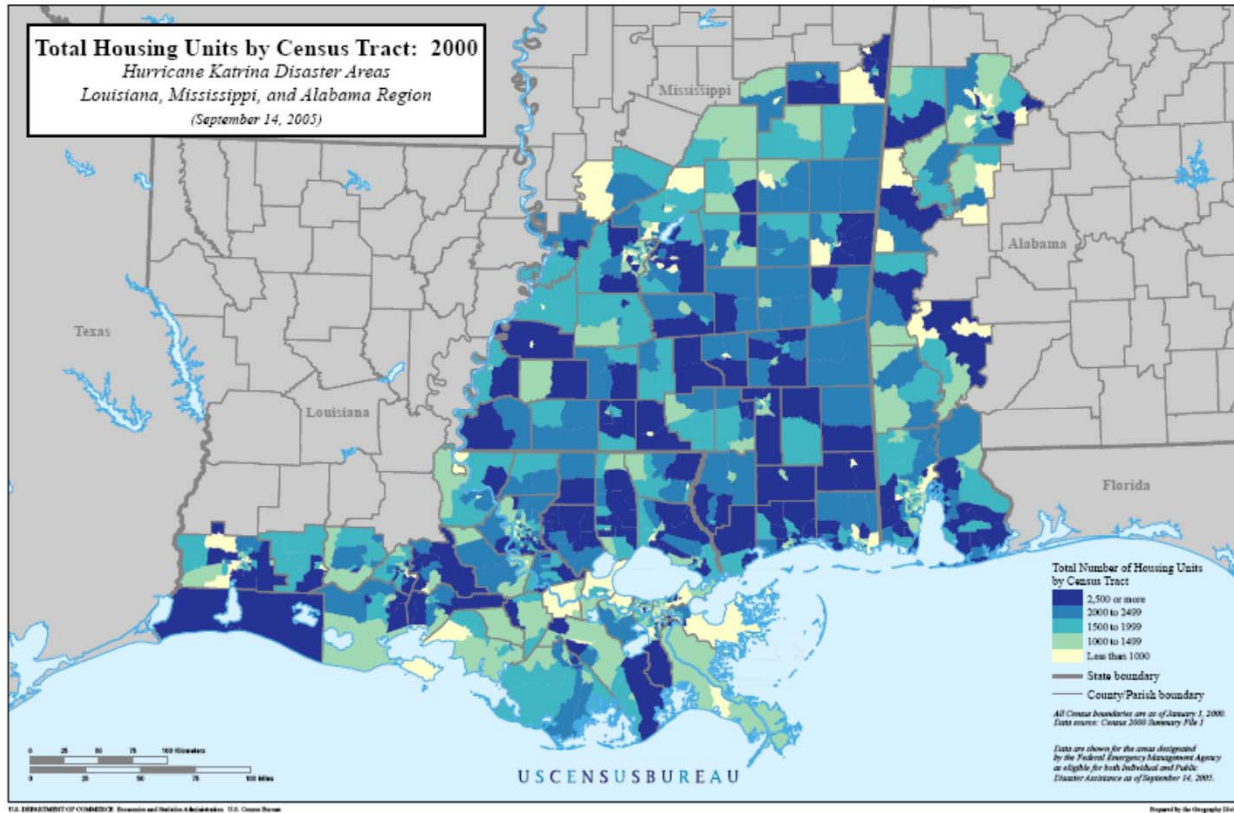
2.1 million homes saw extensive damage, 310,353 homes were utterly obliterated in 3 states (La., Miss., Al.)



The Major Impact Zone of the Hurricane



Scope and Scale of the Housing Needs



Rebuilding Single-Family Homes

- 310,353 single family homes to be rebuilt
- FEMA bringing 125,000 manufactured homes
- Proposing building to **HUD code** (not even as strict as MEC 93)
- What if we did this right?



Who is Doing What?

- **Home Depot** and its suppliers partnered to donate nearly \$1.2 million in products, along with \$4 million in donations from the Home Depot Foundation
- **Congress** seeking to pass bills to shield contractors from litigation that might result from workers in this polluted dangerous area
- In January, the **Bring New Orleans Back Commission** proposed greater flood protection, storm water protection, use of canals, light rail system, improved neighborhood infrastructure, schools, health facilities
- In February, the **Bush Administration** released a review of the Federal response to Katrina, citing 17 “lessons learned”, 125 “special recommendations to the President”, and 11 “critical actions” to be taken before June 1, 2006 (For every action, there’s an equal and opposite...)
- Hospitals along the Gulf Coast, like **MD Anderson Cancer Hospital** in Houston, Tx, have begun relocating their mechanical rooms to higher floors and installing flood gates that automatically drop into place should a flooding event occur
- A pilot project is to be carried out in Pass Christian, Mississippi—one of the hardest-hit areas—under project “Home Again” sponsored by the **Enterprise Foundation, Home Depot Foundation, Oak Hill Fund, John and Renee Grishom Foundation**, with a team that includes **Southface** (Atlanta), **Hope Credit Union**, and local architects. In Pass Christian, the **Mercy Housing Human Development Inc.** (a community housing development organization) has forwarded 6 home-sites (formerly shotgun style homes) for this pilot program—to provide modern housing at a reasonable cost to serve the “low” and “very low” income clients of **Mercy Housing**
- **ICF Consulting** has been modeling various scenarios to inform policymakers; a major modular homes manufacturer has kindly allowed ICF to use their data for modeling their modular type of housing for possible use in the Pass Christian rebuild

Modeling the Impacts of Hurricane Katrina

- Policy advisors requested the assistance of ICF to model various scenarios for the rebuild and answer the question *“What constitutes smart energy choices for the rebuilding?”*

What Constitute Smart Energy Choices for the Rebuilding Efforts?

To answer that, five scenarios were initially studied:

Assumed Baseline: minimum code requirements baseline (MEC 93)

Scenario 1: selected cost-effective measures (Quick Payback)

Scenario 2: newly-adopted code (IECC 2006)

Scenario 3: national energy efficiency program (ENERGY STAR New Homes Guidelines)

Scenario 4: additional cost effective improvements (Best Practices)

Modeling Strategy for Theoretical Rebuilding Effort

- 72,000 DOE-2 runs for 8 cities in 2 Climate Zones using
 - Actual **energy-use** characteristics from home energy raters
 - **2000 Census Bureau** data for homeowners and homes
 - FEMA data was used to illustrate the **scale of the re-build**
 - 2005 Construction Cost Data **cost per home to rebuild**



What Was Modeled for Theoretical Rebuilding?

	Baseline MEC 93	Scenario 1 Quick Payback	Scenario 2 IECC 2006	Scenario 3 ENERGY STAR 2006	Scenario 4 Best Practices
Window SHGC	0.58	0.58	0.40	0.40	0.30
Appliances and Lighting	Standard	ENERGYSTAR labeled	Standard	ENERGYSTAR Labeled	ENERGYSTAR Labeled
Duct Leakage	~13%	~6%	~13%	~6%	~6%
Wall R-Value	13	13	13	13	19+
Attic R-Value	23	~23	30	30	44
AC SEER	10	Upgrade from 13 to 14	13	14	17
Square Footage	2,000 s.f.	2,000 s.f.	2,000 s.f.	2,000 s.f.	2,000 s.f.

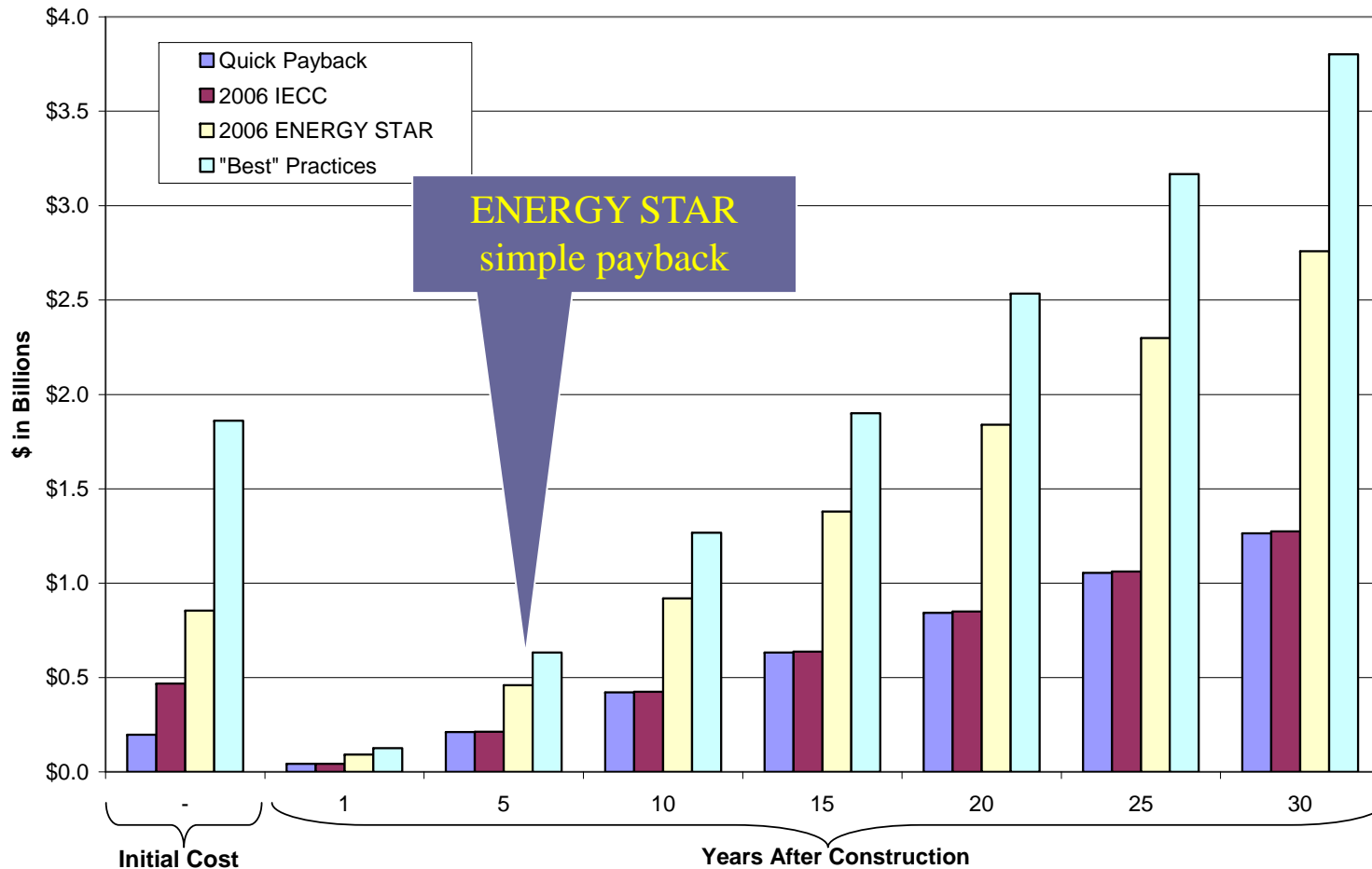
Incremental Cost to Upgrade Per Home (Cost Over Baseline)

		Per Unit			
		(\$)			
Total Units		Scenario			
		1	2	3	4
	Yr	Quick Payback	2006 IECC	2006 ENERGY STAR	"Best" Practices
Incremental Upgrade Cost	-	\$527	\$1,511	\$2,754	\$6,003

Incremental Annual Utility Bill Savings Per Home

		Per Unit			
		(\$)			
Total Units		Scenario			
		1	2	3	4
	Yr	Quick Payback	2006 IECC	2006 ENERGY STAR	"Best" Practices
Incremental Annual Utility Bill Savings	1	\$254	\$179	\$365	\$485
	5	\$1,268	\$894	\$1,777	\$2,427
	10	\$2,536	\$1,788	\$3,555	\$4,853
	15	\$3,804	\$2,683	\$5,332	\$7,280
	20	\$5,072	\$3,577	\$7,110	\$9,706
	25	\$6,340	\$4,471	\$8,887	\$12,133
	30	\$7,609	\$5,365	\$10,665	\$14,559

Investment Cost Versus Cumulative Savings (Relative to MEC 93)



ENERGY STAR New Homes Guidelines

Scenario for Theoretical Rebuild

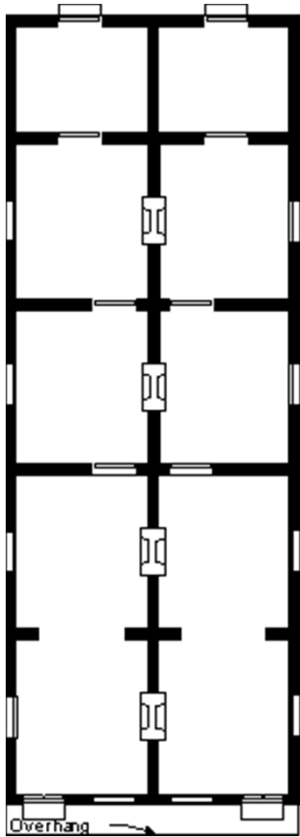
- Cost **\$900 million** initial investment
- **Payback period** is 7.5 years
- Saves **621,860 MWh**
- Saves **713 MW** (about the size of one nuclear power plant)
- CO₂ abated is equal to removing **51,000 cars** from the road

Pilot Program in Pass Christian, Mississippi

- 6 home sites were selected
- Type of home prior to Hurricane Katrina was **single- and double-shotgun style construction**
- Occupants liked this style and prefer to use **natural ventilation 6 mos./year**
- Homes being proposed for pilot program are to be **modular, raised above any future storm surge**

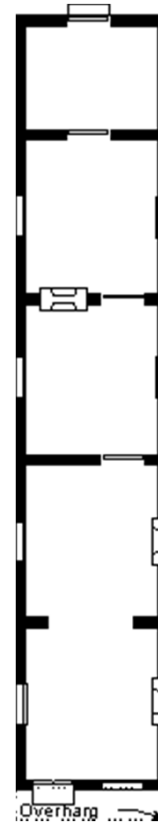


Plans of Shotgun Style Homes



Double shotgun style:

- each room has 3 doors
- no internal hall
- 12' ceilings
- tall windows
- natural ventilation

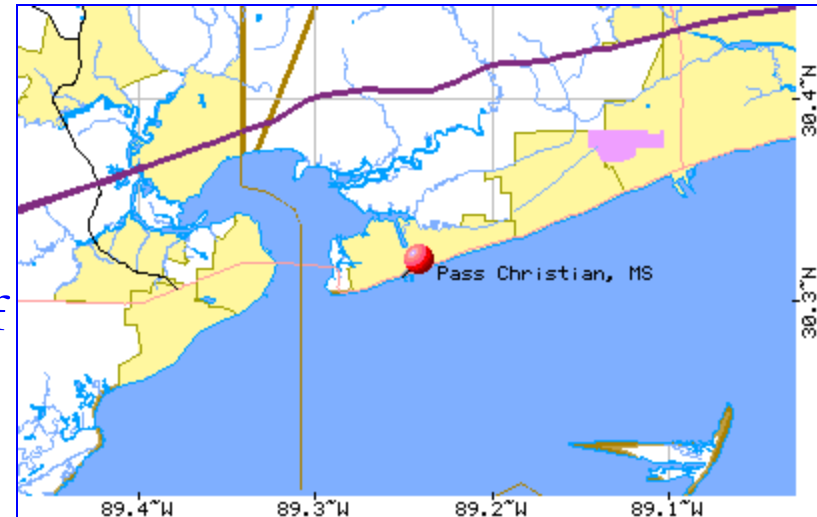


Single shotgun style:

- each room has 2 doors
- no internal hall
- 12' ceilings
- tall windows
- natural ventilation

Modeling Strategy for Pilot Program Rebuilding in Pass Christian

- 192 DOE-2 runs for 1 city in 1 Climate Zone using
 - Pilot program data was used to illustrate the **scale of the re-build**
 - Data on the actual characteristics of the actual **modular homes provided by a major manufacturer**
 - 2005 Construction Cost Data **cost per home to rebuild**



Views of Shotgun Style Homes



What Are Smart Energy Choices for Rebuilding Pass Christian?

To answer that, six scenarios were studied:

Scenario A: minimum code requirements baseline (MEC 93) for a single shotgun style home

Scenario B: minimum code requirements baseline (MEC 93) for a double shotgun style home

Scenario C: modular home with energy efficiency characteristics as provided by a major manufacturer for their medium-size home

Scenario D: modular home with energy efficiency characteristics as provided by a major manufacturer for their large-size home

Scenario E: national energy efficiency program (ENERGY STAR New Homes Guidelines) for single shotgun style home

Scenario F: national energy efficiency program (ENERGY STAR New Homes Guidelines) for double shotgun style home

What Was Modeled for the Pilot Program?

	Scenario A MEC 93 Single Shotgun	Scenario B MEC 93 Double Shotgun	Scenario C Modular Medium Size	Scenario D Modular Large Size	Scenario E ENERGY STAR 2006 Double Shotgun	Scenario F ENERGY STAR 2006 Double Shotgun
Window SHGC	0.58	0.58	0.40	0.40	0.40	0.40
Appliances and Lighting	Standard	Standard	ENERGY STAR Labeled	ENERGY STAR Labeled	ENERGY STAR Labeled	ENERGY STAR Labeled
Duct Leakage	~13%	~13%	~3%	~3%	~6%	~6%
Wall R-Value	13	13	18	18	13	13
Attic R-Value	23	23	33	33	30	30
AC SEER	10	10	13	13	14	14
Square Footage	980 s.f.	1,960 s.f.	1,291 s.f.	1,916 s.f.	980 s.f.	1,960 s.f.

Incremental Cost to Upgrade Pilot Homes in Pass Christian

	Scenario A MEC 93 Single Shotgun	Scenario B MEC 93 Double Shotgun	Scenario C Modular Medium Size	Scenario D Modular Large Size	Scenario E ENERGY STAR 2006 Single Shotgun	Scenario F ENERGY STAR 2006 Double Shotgun
Incremental Cost to Build (\$/s.f.)	-	-	\$3.39 s.f.*	-\$0.36 s.f.**	\$1.24 s.f.	\$0.84 s.f.

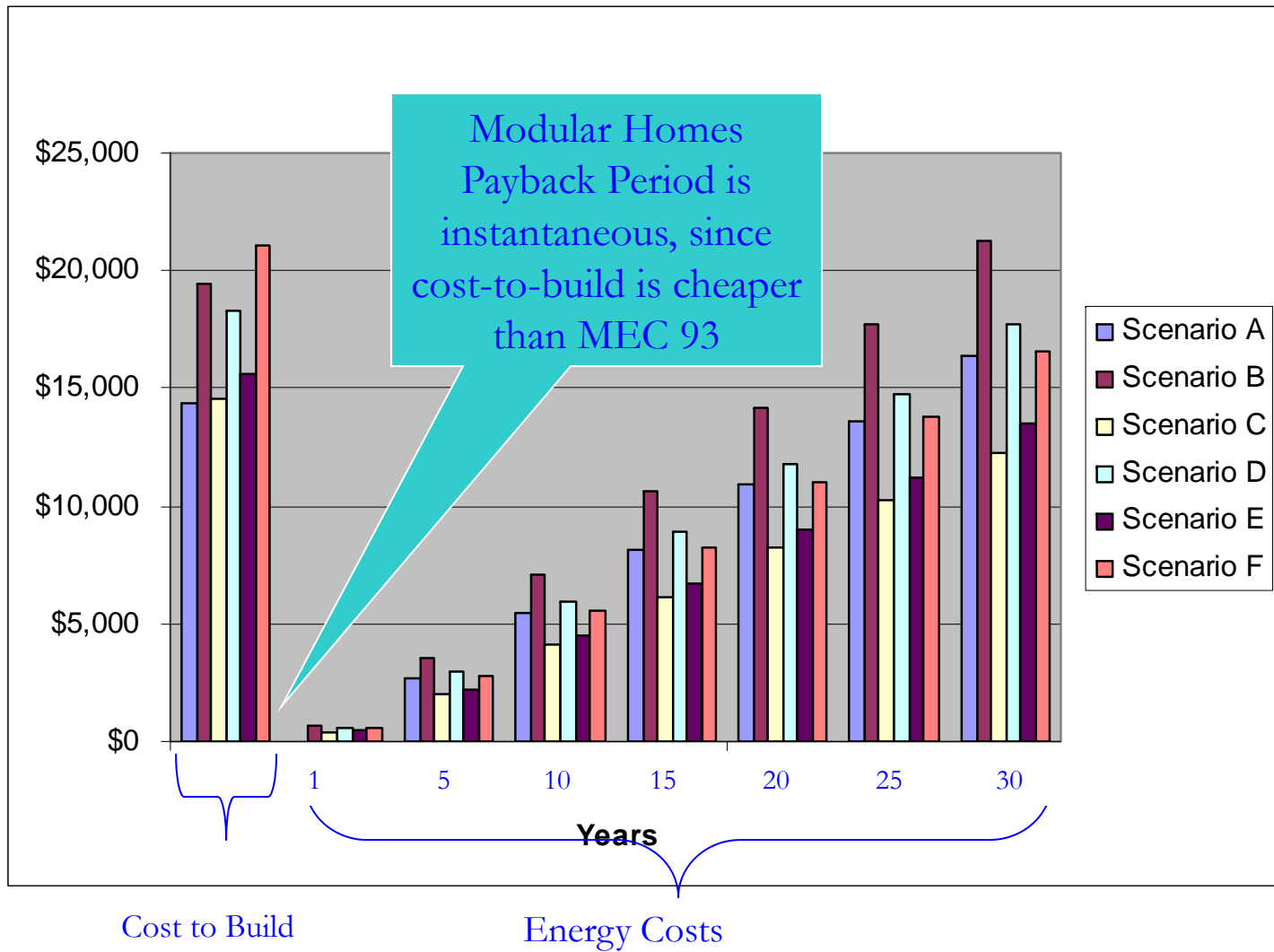
*Not an accurate comparison since the s.f. so different between MEC 93 and Med. Modular

The larger modular home is \$1,129.66 **cheaper overall cost to build (not including profit or mark-up) than MEC 93 scenario.

Cumulative Energy Costs for Pass Christian

MEC 93	MEC 93	Modular	Modular	ENERGY STAR 2006	ENERGY STAR 2006 Double Shotgun
Single Shotgun (980 s.f.)	Double Shotgun (1,960 s.f.)	Medium Size (1,291 s.f.)	Large Size (1,916 s.f.)	Single Shotgun (980 s.f.)	(1,960 s.f.)
\$545	\$710	\$410	\$591	\$450	\$552
\$1,090	\$1,420	\$820	\$1,182	\$900	\$1,104
\$1,635	\$2,130	\$1,230	\$1,773	\$1,350	\$1,656
\$2,180	\$2,840	\$1,640	\$2,364	\$1,800	\$2,208
\$2,725	\$3,550	\$2,050	\$2,955	\$2,250	\$2,760
\$5,450	\$7,100	\$4,100	\$5,910	\$4,500	\$5,520
\$8,175	\$10,650	\$6,150	\$8,865	\$6,750	\$8,280
\$10,900	\$14,200	\$8,200	\$11,820	\$9,000	\$11,040
\$13,625	\$17,750	\$10,250	\$14,775	\$11,250	\$13,800

Incremental Cost Versus Cumulative Energy Costs (Relative to MEC 93)



Recommendation for Pass Christian Considering Natural Ventilation

- Larger sized modular homes with detail options to replicate shotgun exterior styling are recommended for the Pilot Program
- While the modular homes have not been factored with natural ventilation, were the larger modular homes to have the same window configuration (tall) and ceiling heights (12'), and long, open spaces in the homes as the double shotgun style ENERGY STAR site-built, it is probable **modular homes could achieve the savings as the ENERGY STAR site-built double shotgun style** (that is 12.8% more energy savings.)

Modular New Homes Scenario for 6 Homes in Pilot Project, Pass Christian

- Since cheaper to build than MEC 93 double shotgun, the large modular is less expensive to build at outset and returns **\$119 to homeowner's "pocket"** (in cheaper utility bills) each year; that is, **\$21,420 to 6 homeowners in 30 years** (\$24,161 if natural ventilation used for 6 months of the year).
- Saves **234 kW in 30 years**
- Saves **2,310 MBTUs in 30 years**
- **383,400 lbs. CO₂** abated is equal to removing **30 cars** from the road over a 30 year period

Incentives to Make Smart Energy Choices Even Smarter

Nationally:

- Federal **tax credits** available
- Increased **affordability** through energy efficient mortgages (EEMs)

Regionally:

- Home Energy Rebate Option (HERO)
- Home Energy Loan Program (HELP)
- Property Tax Exemption
- Qualified Allocation Plan (QAP)
- Energy Rated Homes of Mississippi Program
- Green Power Switch Generation Partners Program
- Income Tax Credit Program
- State Grant Program

Smart Energy Choices

Not Just Rhetoric—Can Be Made Now!



- **ROI** on starts paying back instantly **for large modular homes**
- Increased household cash **stimulates local economy** and **reduces risk of mortgage default**
- Increases **affordability** if **EEMs** are employed
- Improves **quality of life**

The Consequences of Inaction

Failure to act will make the situation worse

- Sub-standard housing
- Higher energy bills
- Reduced affordability
- Ripple-effect across local and national economies



Implementation

- Develop guidance for builders and sub-contractors (training and skills development)
- Coordinate funding and programs
- Advise policymakers and help them forecast the impacts on the infrastructure
- **Become part of the solution—ICF Consulting has the capabilities to help policymakers project the outcomes to make “smart energy choices”!**

We Make Smarter Energy Choices

*Let's Make It a
Decent Planet By
Putting Good
Buildings On It!*

Thank you!





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