

# The “Second Shot Heard ‘Round the World”

From Lexington in 1775 to Boston in 2023

--The Role of Passive House in the Extraordinary Second American (Energy) Revolution

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November 10, 2023

PHIUS CON 2023, Houston, Texas



# Learning Objectives

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*From the unique perspective of a US-based window manufacturer, my intent is describe:*

1. Brief Recap of *History of Passive House in United States*
2. Describe of the principle drivers of growth for Passive House in the last several years;

## ***STOP and CHANGE DIRECTIONS***

3. Review the history of recent natural resource **REVOLUTIONS**;
4. Bring up to date and discuss *the intersection* of **PASSIVE HOUSE** and the **ENERGY REVOLUTION**.
5. Use the lessons of history to boldly predict the future.



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**EVERYONE, HOLD ON TO YOUR SEAT, WE'RE GOING TO REVIEW A 30 MINUTE PRESENTATION IN 5 MINUTES**

**BRIEF RECAP OF HISTORY OF PASSIVE HOUSE IN NORTH AMERICA FROM 2022 PHIUS CON**



**STEP ONE:**

**PASSIVE  
SOLAR  
DESIGN**



# The Origins of "Passive House" Can Be Traced Back Thousands of Years

15<sup>th</sup> Century BC

The earliest known reference to use solar energy during reign Egyptian ruler Amenhotep the Great



7<sup>th</sup> Century BC

North American Anasazi Native Americans build into south side of cliffs to consider solar exposure



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# The Origins of "Passive House": Let's Fast Forward a Few Thousand Years

The use of passive solar design begins to blossom in the United States:

- **1880 in the Northeast** The earliest version of homes designed to make intentional use of solar heating began to appear in Salem, Massachusetts (Professor E.L. Morse)
- **1930s in the Upper Midwest** 1930s relatively modern designs of passive solar homes began to be built in the relatively colder climate of Minnesota
- **1940s in Chicago** The Keck brothers in Chicago built prefab building in Chicago with large, south facing windows with overhangs, to admit sunshine in the winter but block it in the summer months
- **1941** *Your Solar House* is published, funded by Libbey-Owens-Ford Glass Company (now Pilkington), and included 48 designs (*one for each state at the time*) of homes designed to utilize direct gain solar energy according to the unique geographic climate and building traditions of the time (a precursor to an contributed to an issue central to the PHIUS and PHI split 60 years later)



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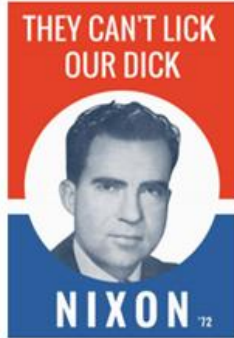
THE "OVERNIGHT" EXPLOSION OF PASSIVE HOUSE . . . OVER THE LAST 50 YEARS!

## So Where Did the Concept of the *Modern Passive House* Come From Anyway?

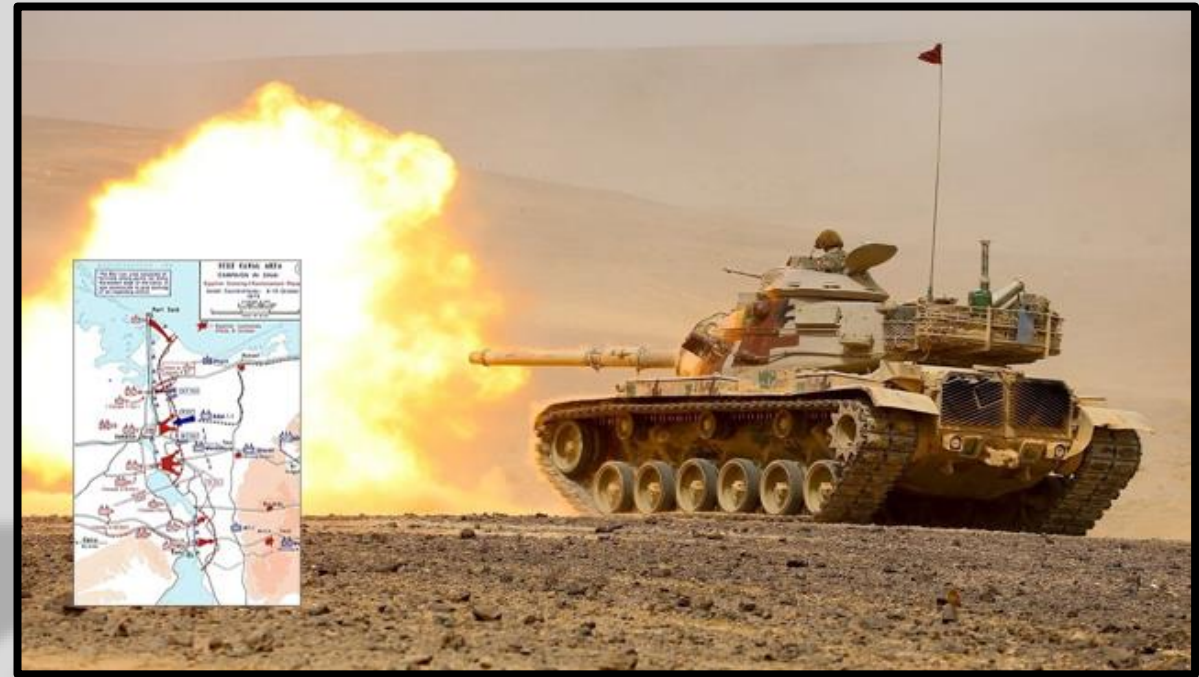
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History Can Firmly Point Its Finger at a Single  
Person as the First Mover of the Movement





Huh? Let Me Explain



## 1973 Yom Kippur War in the Middle East

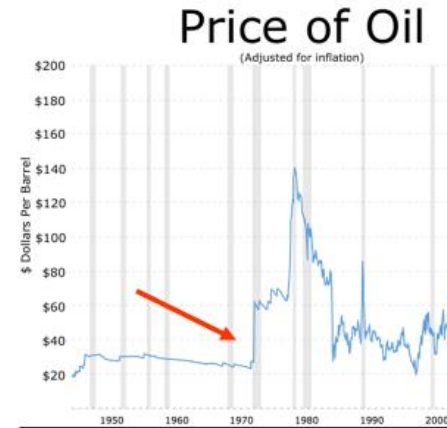


Nixon Requests \$2.2 Billion in Aid for Israel



The Arab World Responds with the Oil Embargo

## Oil Prices Skyrocket and Energy Conservation Takes Center Stage



Carter Forms Department of Energy in 1977

Plays with Americans to Turn Down Thermostats

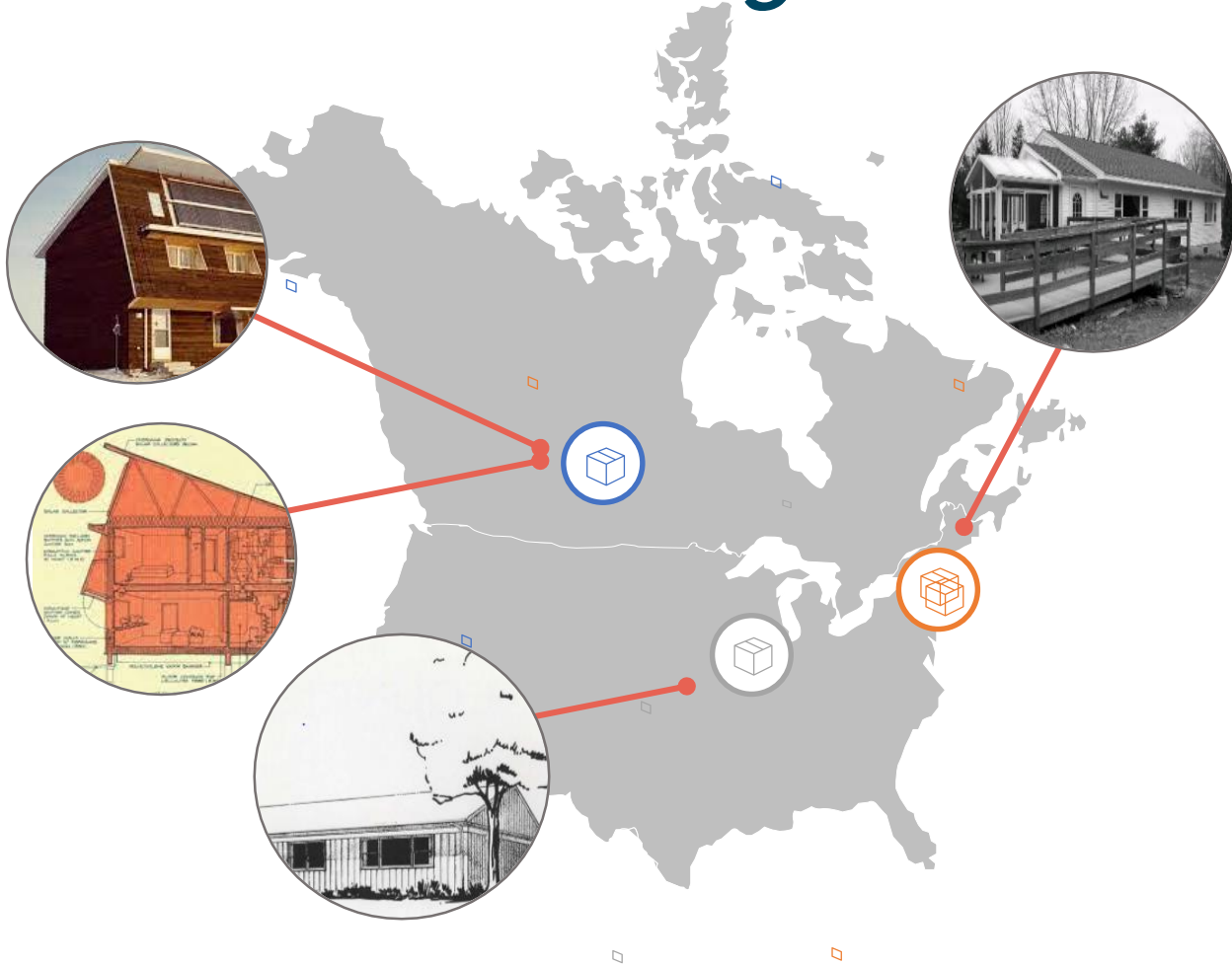






**STEP TWO:  
ADD SUPER INSULATION**

# Three Influential *Super-insulated* Home Designs— the “*Original Passive House*” Designs?



**1977** Ledger House  
Pepperrel, Massachusetts



**1977** Saskatchewan Conservation House  
Regina, Saskatchewan



**1976** Illinois Lo-Cal House  
Urbana, Illinois



## Enter the Great Communicator (Another) physicist William Shurcliff



Reading about other solar designers was "*infuriating*," he told the New York Times. "*Half the information was missing, and systems were vaguely described as 'ingenious' without explaining why they were ingenious or how well they worked. Sense had to be made of it.*"

Author of 100s of articles and dozens of books, he set about to explain the intersection of passive solar design and super-insulation.

Describing what he saw in these 3 *super-insulated and passively heated homes*, Shurcliff described . . . "passive house" for the first time:



He described a new category of a building that included:

1. Truly superb insulation;
2. Airtight envelopes;
3. No provision of extra thick thermal mass;
4. Non-oversized furnaces;
5. No conventional air movement;
6. No weird architecture;
7. No extra expense;
8. Modest passive heating;
9. Normal humidity around 50% year-round;
10. South windows are small enough to be shielded by eaves.

Great communicator but kinda' sucked at coining phrases, right?

*What name should be given to this new system?*

*Super-insulated passive? Super-save passive? Mini-need passive? Micro-load passive? I lean toward 'micro-load passive.'*

**Whatever it is called, it has I predict a big future."**

*June 1979*



Physicist William Shurcliff

## Oil Prices Plummeted . . . Interest Faded Fast



Oil Prices in the U.S.  
Dropped!

*I don't have a short attention span. I just... Oh look! A squirrel!*

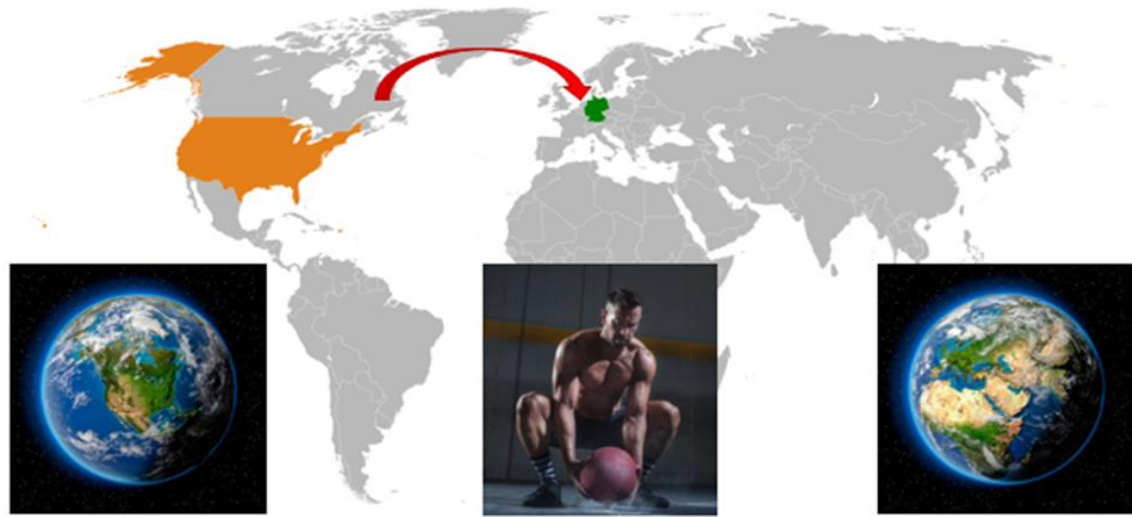




**STEP THREE:**  
**A SYSTEM IS PUT IN PLACE**  
**TO GERMANY AND BACK**  
**STORY OF A “WOLF” AND A “CAT”**







## Picking up the Ball in Germany

## The Wolf: Wolfgang Feist and the Passive House Institute

- Inspired by the writings of Schurcliff and fellow physicist Amory Lovins, among others, Feist picks up the ball
- Adding to this work, attached a comfort objective, creating performance standards and a defined process to achieve the standard, announces a **Passivhaus** system of building.
- He builds in Darmstadt, Germany, a prototype of the first Passive House in 1990, and established the Passive House Institute.



## The Cat: Katrin Klingenberg and PHIUS



- Katrin Klingenberg discovered passive house while studying architecture in Berlin and re-introduced the modified, passive house principles to the United States.
- In 2003, Klingenberg completed the first home in the United States built to PHI standards, and she later became the co-founder of Passive House Institute US (PHIUS).
- As the passive house movement gained new momentum, Klingenberg and others at PHIUS found that the single performance metric of PHI did not work for North America's extreme variations in climate.
- In 2015, PHIUS released the PHIUS+ standard, the only passive building standard to consider cost-effective and climate-specific performance criteria.

## Passive House Explodes on the Scene A US High-Performance Window Manufacturer's Story

### PHIUS Conference at the University of Illinois Urbana-Champaign in 2009

Calculation based on ISO 5817-2, EN 673, EN 410

Climate specific recommendations	Climate specific recommendations		Climate specific recommendations		Climate specific recommendations	
	U <sub>g</sub> [W/m <sup>2</sup> K]	U <sub>w</sub> [W/m <sup>2</sup> K]	U <sub>g</sub> [W/m <sup>2</sup> K]	U <sub>w</sub> [W/m <sup>2</sup> K]	U <sub>g</sub> [W/m <sup>2</sup> K]	U <sub>w</sub> [W/m <sup>2</sup> K]
0	0.75	0.13	0.333	0.417	0.274	0.274
1	0.74	0.13	0.333	0.397	0.274	0.274
2	0.72	0.13	0.333	0.376	0.264	0.264
3	0.72	0.13	0.333	0.373	0.264	0.264
4	0.72	0.13	0.333	0.373	0.264	0.264
5	0.72	0.13	0.333	0.373	0.264	0.264
6	0.72	0.13	0.333	0.373	0.264	0.264
7	0.72	0.13	0.333	0.373	0.264	0.264
8	0.72	0.13	0.333	0.373	0.264	0.264
9	0.72	0.13	0.333	0.373	0.264	0.264
10	0.72	0.13	0.333	0.373	0.264	0.264

PHIUS Conference at the University of Illinois Urbana-Champaign in 2009





**PART FOUR:  
FUELING THE PASSIVE HOUSE FIRE**



## How the Great Schism of 2011 between PHI and PHIUS Actually Accelerates Forward the Movement

- European-based PHI and the North American -based PHIUS groups formally split in 2011
- As a result, **passive house movement** in North America actually dramatically accelerates
- Why?



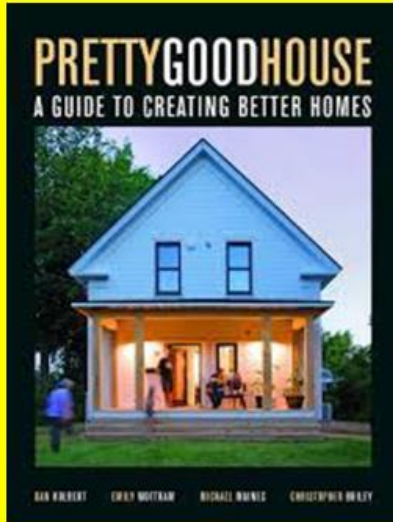
## The "Two Christmases" Syndrome



- **More suppliers** enter the market (lower prices, more choice, less supply risk)
- **More consultants, architects, builders** enter the market—some attracted and to an extent loyal to one camp and others not;
- Twice the conferences and twice the associations
- **More friendly and appropriate North American standards** (critical for government adoption)
- Less rigidity, favoring European biases
- More competition, more conflict, more discussion



## THE RISE OF THE "GOOD ENOUGH" PASSIVE HOUSE



## AFFORDABLE HOUSING AND PASSIVE HOUSE

- STARTING IN PA AND QUICKLY SPREADING TO NY AND CT AND MASS AND MANY OTHER STATES, AFFORDABLE HOUSING PROJECTS ARISE USING PASSIVE HOUSE
- NOT MANDATED BUT ADDED AS QUALIFYING PREFERENCE FOR QAP IN FEDERAL AND STATE LOW INCOME TAX CREDITS
- A CRITICAL TRIAL OF PASSIVE HOUSE BUILDING IN MANY PARTS OF THE COUNTRY





# SO LET'S RECAP . . .

## THE ORIGINS OF PASSIVE HOUSE BEGIN IN NORTH AMERICA

Passive Solar Design

Arab Oil Embargo fuels Super Insulation+ Added

Shurcliff describes the passive house system for the first time

US loses interest as oil prices fall

## FEIST PUTS PASSIVE HOUSE INTO A SYSTEM (DUPLICABLE—REPEATABLE—UNDERSTANDABLE—MEASURABLE)

Passive House Institute is developed

## KATRIN KLINGINBERG IS THE APOSTLE WHO BRINGS PH TO THE US

PHIUS is born and develops

## THE CRITICAL “NORTH AMERICANIZATION” OF PASSIVE HOUSE LEADS TO BREAK OF PHI AND PHIUS

Fueling the broader passive house popularity ironically

Out of the “schism” comes an acceleration of the “pretty good house”

Further fuels multiple approaches to affordable housing and state adoption and trial

Critical to success of the PH Movement is the broadening of supply solutions and sensible outcomes

***PASSIVE HOUSE GROWS QUICKLY IN EARLY TRIALS AS “VOLUNTARY” PERFORMANCE PATHWAY OPTION***



**Now let's turn our attention to REVOLUTION!!!!**

An aerial, black and white photograph of a dense industrial city. Numerous buildings, factories, and chimneys are visible, with thick plumes of smoke or steam rising from the structures, creating a hazy atmosphere. The perspective is from a high angle, looking down on the urban landscape.

4

**STAGES OF  
NATURAL  
RESOURCE  
REVOLUTIONS**



**1**

**A New Natural  
Resource Becomes  
Broadly Available**

2

**An Early Innovation  
Triggers Rapid Early  
Commercialism**

3

**Society Intervenes  
To Control, React  
and Set Rules**



# 4

## **THE GOLDEN AGE**

**Rapid Widespread  
Commercialization Follows**

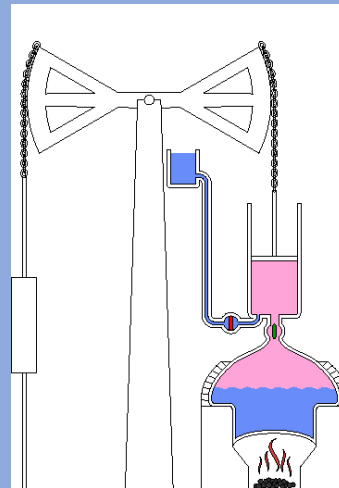
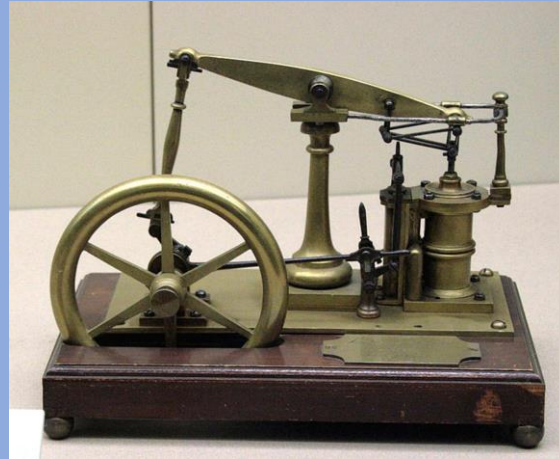
**Winners and Losers Emerge**

## RESOURCE



# COAL

## TRIGGERING INNOVATION



## WATT'S STEAM ENGINE POWERS INDUSTRIALIZATION

## SOCIETY INTERVENES

- UTILITY SCALE ELECTRICITY
- REGIONAL TRANSPORTATION
- REGIONAL COMMUNICATION
- URBANIZATION
- SOCIAL PROGRAMS
- **WAR AND WEAPONS**

## GOLDEN AGE EXAMPLES

- STEAMSHIPS
- RAILROADS
- REGIONAL MERCHANTS
- INDUSTRIAL MACHINERY

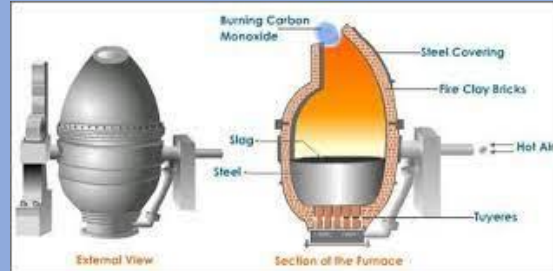


## RESOURCE



## IRON ORE

## TRIGGERING INNOVATION



**BESSEMER OVEN PROCESS CREATES ACCESS CHEAP PLENTIFUL STEEL**

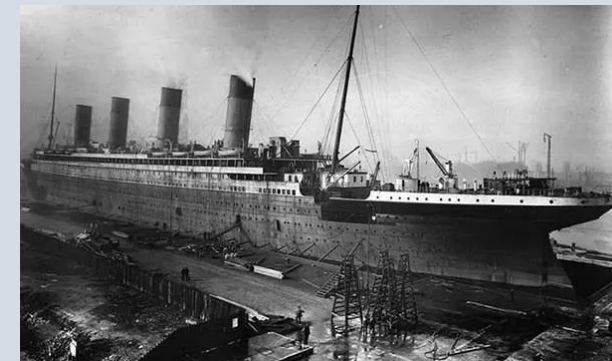
## SOCIETY INTERVENES

- TRANSPORTATION OF LARGE LOADS
- BRIDGES
- WEAPONS
- INFRASTRUCTURE
- PUBLIC CAPITAL PROJECTS
- **WAR AND WEAPONS**



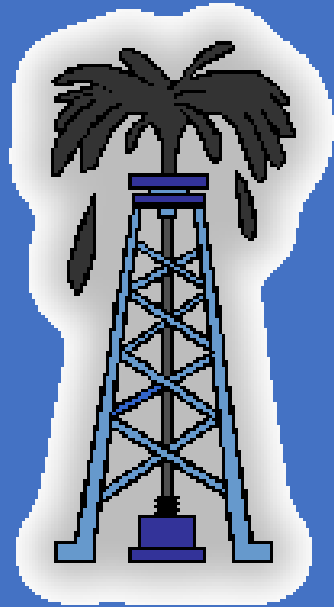
## GOLDEN AGE EXAMPLES

- STEEL MILLS
- SKYSCRAPERS
- RAILROADS
- GIANT SHIPS
- BRIDGES



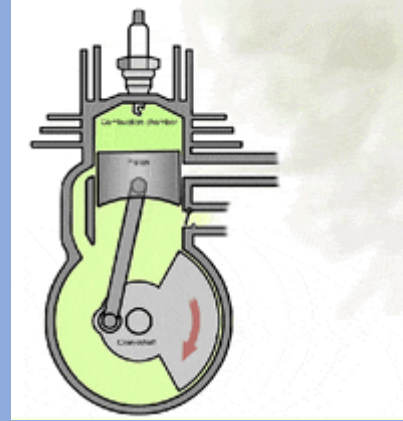


## RESOURCE



# OIL/GAS

## TRIGGERING INNOVATION



## INTERNAL CUMBUSTION ENGINE

## SOCIETY INTERVENES

- HIGHWAYS
- AIRPORTS
- GLOBAL TRANSPORTATION
- GLOBAL COMMUNICATION SYSTEMS
- SUBURBANIZATION
- RESIDENTIAL LIGHTING
- **WAR AND WEAPONS**



## GOLDEN AGE EXAMPLES

- AUTOS
- MALLS
- FAST FOOD, FAT PEOPLE
- APPLIANCES
- PLASTICS
- STANDARDIZED BUILDING MATERIALS



## RESOURCE



# DATA

## TRIGGERING INNOVATION



## TRANSISTOR

**LEADS TO DATA  
COMPUTING AND  
THE AGE OF  
INFORMATION**

## SOCIETY INTERVENES

- WORLD WIDE WEB
- DOMAIN NAMING SYSTEM
- GLOBAL COMMUNICATION INFRASTRUCTURE AND GOVERNANCE
- GPS
- CODES, OVERSIGHT
- **WAR AND WEAPONS**

## GOLDEN AGE EXAMPLES

- E-TAILING 
- INTERNET ENABLED PAYMENT SYSTEMS
- LAPTOP COMPUTING
- PORTABLE PHONES
- DIGITAL CAMERAS
- SATELLITE COMMUNICATION



A black and white close-up portrait of Winston Churchill, showing his face from the nose up. He has a serious, thoughtful expression, with deep wrinkles on his forehead and around his eyes. The lighting is dramatic, highlighting the texture of his skin and the intensity of his gaze.

**HISTORY  
IS WRITTEN BY  
THE VICTORS**

---

Winston Churchill

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# RESOURCE

# TRIGGERING INNOVATION

# SOCIETY INTERVENES

# GOLDEN AGE EXAMPLES



- MASSIVE PUBLIC UTILITY SCALE INVESTMENTS AND INFRASTRUCTURE
- PUBLIC/GOVERNMENT INCENTIVES
- BUILDING CODES DEVELOP

- ELECTRIC CAR
- THIN FILM SOLAR
- LITHIUM BATTERIES
- BEING WRITTEN AS WE SPEAK

(MORE ON THAT . . . .  
IN A MINUTE)



# RENEWABLE ENERGY

# SOLAR PANEL AND WIND TURBINE (AND BATTERIES)

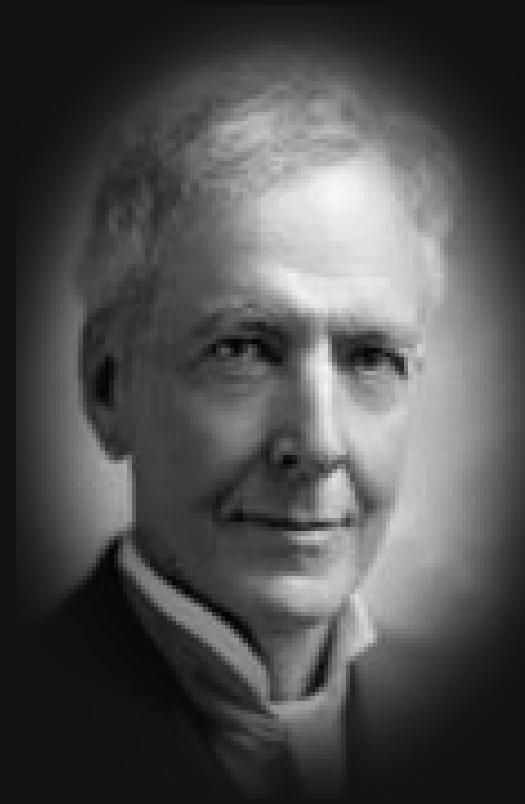
- **WAR AND WEAPONS?**

**(MORE ON THAT . . .  
IN A MINUTE)**



Those who are  
making history  
seldom have time to  
record it.

*Luther Burbank*



## **SECOND RECAP**

**We reviewed the history of Passive House in North America**

**Remember it is used and trialed residentially and commercially BUT ALWAYS as an optional pathway**

**Incentives;**

**Policy preferences;**

**Qualifying credits for allocation of dollars;**

**Rebates.**

**IT IS NEVER FORCED UNDER A BUILDING CODE OR A GOVERNMENT MANDATE**

**We discussed (and showed examples of) repeated patterns of the past in “natural resource” revolutions**

- **Newly accessible abundant natural resource**
- **Triggered by key innovation(s) to be used in new ways**
- **Society intervenes with rules to benefit the greater good and de-risks the broader use by society**
- **A second wave of innovation dramatically accelerates the use of the natural resource**



# The “Second Shot Heard ‘Round the World”

From Lexington in 1775 to Boston in 2023

--The Role of Passive House in the Extraordinary Second America Climate Revolution



# Along Comes Massachusetts . . .

## Famous for Rocks and Sox





**And a Few Other Thing . . .**

**ALWAYS A PROGRESSIVE POLITICAL LANDSCAPE**

**Famous Also as the Birthplace of the American Revolution**





**PHIUS CON 2017  
SEATTLE**

I'm from MA Housing Authority.  
I've sent here to learn what this  
"Passive House" buzz is all about?



# Within the year, eight Passive House Projects Were Supported with Grants

## MassCEC Passive House Design Challenge



Last year, the Massachusetts Clean Energy Center instituted a design challenge for affordable housing developers to build new projects to the Passive House standard and demonstrate that Passive House can be done with a

low cost premium. So far, eight projects have been awarded grants across the state, totalling more than \$1.7 million in funding.

This includes Finch Cambridge, a 98-unit affordable project near the Alewife MBTA station and Mattapan Station, a 135 unit affordable project near the last stop on the Mattapan Trolley/Red Line Extension.

You can read more about these projects and the MassCEC program in

[this interview from Passive House Accelerator.](#)

- 2017 “What’s this ‘Passive House’ All About?”
- 2017 Massachusetts Clean Energy Center (MassCEC) launched the Passive House Design Challenge
- 2020 One Passive House Multifamily Project Certified
- 2022 Two Certified and Five More Completed (in certification)
- Mid-2022 135 More Passive House Buildings in Design or Under Construction







# Remember the Role of “Society” in Earlier Natural Resource Revolutions?

React and Make Rules and De-Risk . . . Over Long Periods of Time

**IN THE CURRENT ENERGY REVOLUTION, THIS IS VERY DIFFERENT FOR A VERY IMPORTANT REASON**



# ALL GREAT REVOLUTIONS START WITH DEFINING MOMENTS



***FIRST SHOT HEARD ROUND THE WORLD***  
***Morning, April 19, 1775***  
***Lexington, Massachusetts***

# **Lightening Fast Time Frame of Developments**

## **Second American (Energy) Revolution**

**March 26, 2021**

**Massachusetts Gov. Baker Signs Sweeping Climate Change Bill into law**

**Moved authority to update stretch energy code to Department of Energy Resources**

**Obligated DOER to create new Municipal Opt-in Specialized Energy Code**

**June 24, 2022**  
**Specialized Stretch**

**DOER releases draft code language for new Stretch Energy Code and Opt-in Energy Code**

**October 27, 2022**

**DOER announces Final Rules for New Stretch Energy Code**

**January 1, 2023**  
**Specialized Stretch Energy Code**

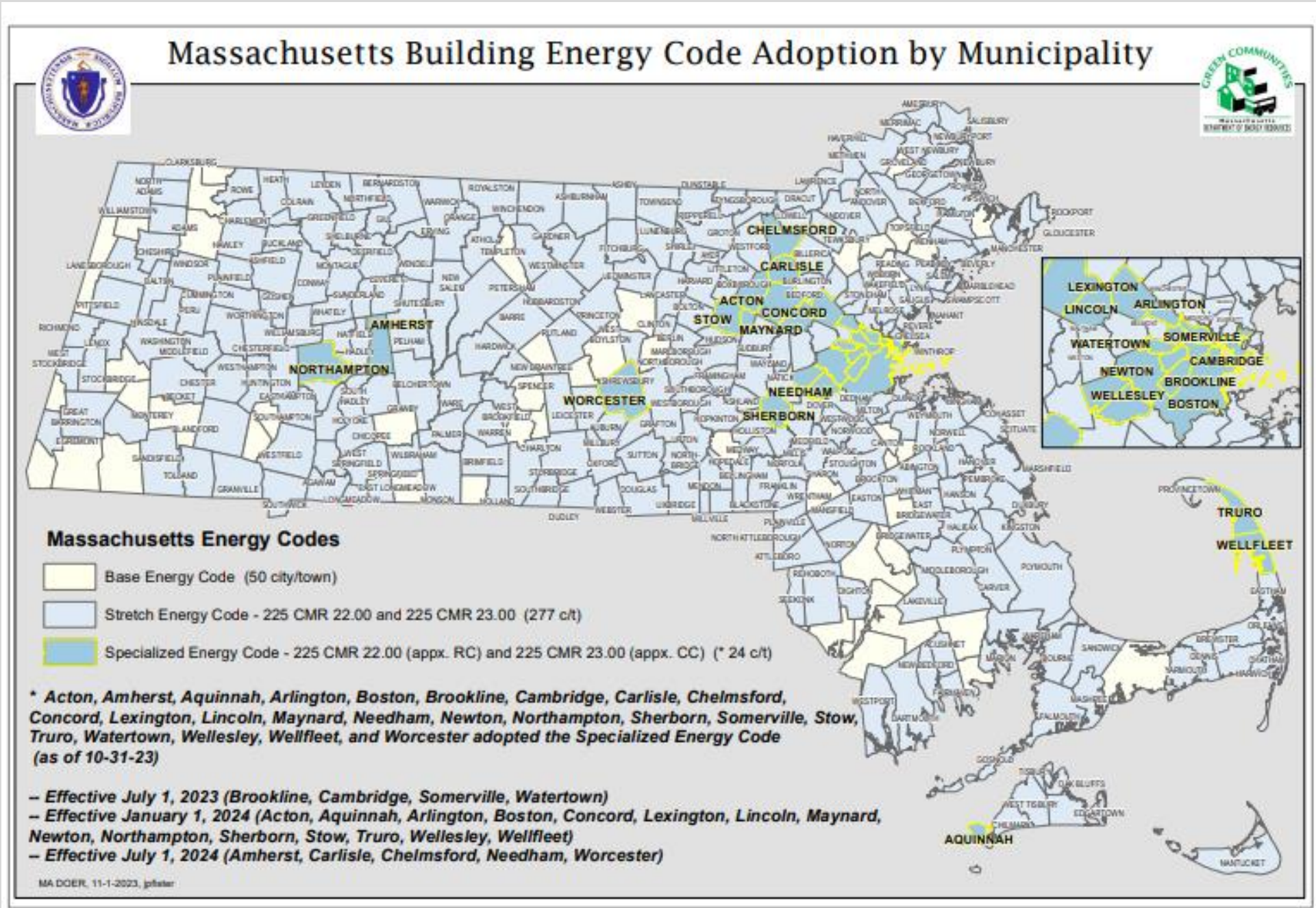
**Stretch Energy Code Takes Effect (allowing for Municipal Opt-In to**

**January 23, 2023**  
**Code**

**City of Cambridge becomes first city to Opt-in to Specialized Stretch Energy**



Acton  
 Amherst  
 Aquinnah  
 Arlington  
 Boston  
 Brookline  
 Cambridge  
 Carlisle  
 Chelmsford  
 Concord  
 Lexington  
 Lincoln  
 Maynard  
 Needham  
 Newton  
 Northampton  
 Sherborn  
 Somerville  
 Stow  
 Truro  
 Watertown  
 Wellesley  
 Wellfleet  
 Worcester





## THE SECOND SHOT HEARD 'ROUND THE WORLD





# APRIL 5, 2023

## The Boston Globe

**Boston City Council votes to adopt new climate-friendly state building code**



**Boston joins three smaller neighboring cities and "Opts-In" to Specialized Stretch Energy Code**

**(24 cities as of 10/31/23)**



**April 19, 1775**

**10 MILES**

**248 YEARS APART**

**THE TWO MOST  
IMPORTANT REVOLUTIONS  
IN US HISTORY ARE SET  
INTO MOTION**

**APRIL 5, 2023**



# IMPLICATIONS AND IMPORTANCE

- The eight largest city in the United States
  - By far the largest political entity to make passive house compliance **prescriptive** for the first time (in multifamily buildings 12,000+ sq ft in size beginning in 2024)
- Boston also has the third largest architectural community in the United States and is among the most influential in the world
- Unprecedented moment in the current energy revolution and made possible by low cost and scalable solar and renewable energy

## Boston skyscraper named world's biggest 'Passive House' office

The building, which will use far less energy than a conventional design, is the latest example of the efficiency standard's growing popularity.

11 October 2023



Winthrop Center in downtown Boston is now the largest Passive House office space in the world. (Millennium Partners)

# **Predicting the Future . . . and a Word on Windows**

- **There will be a massive period now of innovation and commercialization**
- **There will be a big backlash and attempt to slow down progress by the status quo establishment**
  - **False narratives will explode – affordability at the forefront**
  - **Political lobbying will go into hyper-drive**
  - **An attempt to stop the spread will be main rallying cry**
- **Winners and losers will begin to appear – particularly in the building materials space**





# *As Boston's New Mayor Seeks Big Changes, Old Power Brokers Push Back*

Mayor Michelle Wu is striving to keep her campaign promises, but powerful lobbies are throwing up roadblocks.

# Predicting the Future . . . and a Word on Windows

- **Extraordinary opportunities will appear for those with their eyes open**
- **On windows, one or two major US window companies will make the innovation leap to participate and will be big winners**
  - **But will need to have the insight to think about windows differently (how to engage the market, think about window performance and speak the language)**
  - **Being successful with whole building air infiltration testing will separate contenders from pretenders**
  - **Almost as certain, there will be several majors US window brands that will ultimately fail to innovative or respond that will quickly become modern day examples of another *Kodak, Bethlehem Steel, Oldsmobile and Toys R Us***
- **The same will hold true for most market segments**

# Questions?

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