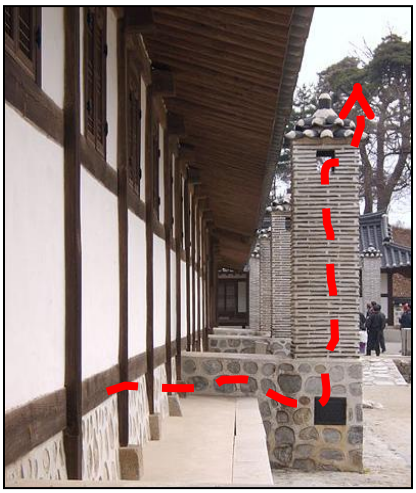
Please send your updates or feedback to Hap@USGreeenHome.com



35 BCE Korean "Ondol" or heated stone radiant floor system

5th century post and beam construction with wattle and daub walls similar to the Korean home above.

THE BUILDING "SCIENCE" TIMELINE ~ according to Hap

A collaborative Building Science community project

BLUE = Key basic science that lays the foundation for the applied engineering

400,000 BCE: Wide spread use of fire
Perhaps discovered by Ug the Caveman as far back as 1.7 million years ago, but everything back then is a little sketchy.

EARLIEST Insulation – natural resource
Sod, and other organic material, mud, animal hides, stones

LATER Insulation – more emphasis on manipulation of resource
Straw, cotton, wood, sawdust, hemp, wattle and daub, earth and cob, tapestries, double walls, as well as, all the materials above

35 BCE Korean radiant floors
The chimney pulls combustion gasses from the kitchens on the other side of the house through a stone floor "flue" in-turn radiating heat to the house.

100 CE Roman radiant floors
heated water carried in pipes

100 CE Roman insulated piping
Cork

1765 Invention of "Modern" low pressure steam engine
James Watts improves the 1712 Thomas Newcomen atmospheric steam engine and puts the industrial revolution into high gear. Steam systems were not really safe for homes for another 100 years (see below).

1662 Robert Boyle – Boyle's Law

1735 Daniel Bernoulli – Kinetic Theory of Gasses

1790 Rittenhouse Stove
Ben Franklin reworked the "inverted siphon" concept originally introduced in 1618 by Franz Kessler, 1624 by Louis Savot, and chronicled by Nicolas Gauger in his 1713 book *The Mechanics of Fire*. The original 1741 Franklin Stove insert never worked well, but David Rittenhouse redesigned the unit that became commercially successful across America.

BUILDING "SCIENCE" TIMELINE

Daniel Bernoulli

1796 Rumford Fireplace invented
Benjamin Thompson (Count Rumford) Publishes "Of Chimney Fireplaces" after researching and installing 250 designs in London.

1816 Richard Trevithick patents medium pressure (40-50 psi) steam engine –the Cornish Boiler
Efficiencies are improved with higher temperatures and pressures. As temps go up so does the need to insulate. Samuel Groase worked with Trevithick and is credited with insulating the boiler, engine, and pipes.

1822 Joseph Fourier – Theory of Heat Flow

1824 Nicolas Léonard Sadi Carnot – 2nd law of Thermodynamics
1843 James Prescott Joules – Mechanical Equivalent of Heat
1850 Rudolf Clausius – 1st Law of Thermodynamics

1857 Polytechnic Club
Leading manufacturers came together to research boiler safety. Formed The Hartford Steam Boiler Inspection and Insurance Company in 1866 after the 1865 Mississippi River steamer Sultana exploded and took over 1,200 lives.

1858 H. W. Johns Manufacturing Company
Asbestos shingle and insulation company later to become the Johns-Manville Corporation and manufacture rock wool, fiberglass and foam insulation. Other early adopters of asbestos insulation include: Celotex (Carey Manufacturing), GAF/Ruberoid,

1867 Invention of Water Tube Boiler
Patents by George Babcock & Stephen Wilcox. Steam boiler with large drum on top is safer and more efficient – becomes the standard for commercial boilers.

1871 Mineral Wool
Slag wool was invented in Wales in 1840 but never used. The first commercial manufacturing was by the Georgsmarienhütte Company. The major component was slag from the company's steel mill. The company was created by George the V of Hanover and his wife Marie In 1856.

1894 ASHRAE founded
The American Society of Heating, Refrigerating and Air Conditioning Engineers

1922 Bryan Steam LLC - Carried the Water Tube Steam Boiler into homes

Inventor and business man Michael Owens

1933 Dale Kleist discovers fiberglass for Owens

1934 Johns-Manville contractor with blown-in rockwool

Gasoline around the block in 1973

BUILDING "SCIENCE" TIMELINE

1904 Michael J. Owens patents the automatic glass bottle machine
He also developed the technologies to automate the manufacture of electric light bulbs, kerosene lamp fonts, bottles, and window glass. He incorporated Owens-Illinois Glass Company, and merged to form Owens-Corning Fiberglas and the Libbey-Owens-Ford company.

1930 Thermopane window glass
Insulating glass was invented and patented by Thomas Stetson in 1865 but commercialized by C.D. Haven in the 1930s.

1933 Fiberglass discovered by Dale Kleist
Kleist a Corning engineer, discovers glass fibers by accidentally blowing a jet of air through molten glass

1938 Owens-Corning Fiberglas® Corporation created through a merger of Owens-Illinois and Corning Glass

1940s Sheetrock spread through the building industry
A crude version of drywall was originally invented in 1916 by the US Gypsum Company. Originally called Sackett Board and then sheetrock, multiple layers of gypsum are compressed and sandwiched between two pieces of heavy paper to form an alternative building material in the place of the time-consuming application of plaster. Although Sackett Board was largely refined in the following years, the construction industry ignored its presence until the majority of the US workforce was shipped off to fight in World War II.

1945 – PPG introduces *Twindow*® double-paned insulating glass to the market.

1946 Libbey-Owens-Ford Thermopane factory opened
to manufacture insulated window glass.

1940s Commercial rollout in plywood in the building industry
Swedish engineer Immanuel Nobel invented the rotary lathe in the 1800s. This made the manufacturing of plywood possible, but plywood use was limited until World War II.

1970 1st Earth Day

1973 Oil Embargo

1976 Congress creates the Weatherization Assistance Program (WAP)

1979 - Blower Door brought from Sweden to Princeton, NJ by Ake Blomsterberg

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BUILDING "SCIENCE" TIMELINE

1979 – The first automated combustion analyzers are introduced: The Enerac 842 in the USA and the Testoterm 31 in Europe (testo)

1989 – PPG introduces Sungate® 300 the first Low-E glass