Chapter Eight – This or That? Intelligent Responses for Where We Work & Live

There is much afoot to suggest we need to rebuild or deeply retrofit a lot of buildings in a relatively short time to achieve a variety of targets as well as certain building codes. This chapter will start with what seems to be benchmark new builds for various purposes and then puts forward some intelligent responses when it comes to retrofits. Retrofitting must be the most common approach.

World's first vertical forest complete

A model of vertical densification of nature within a city, the ambitious project broke ground in late 2009. It was designed as part of the environmental rehabilitation of Milan – one of the most polluted cities in the world.

http://www.treehugger.com/green-architecture/another-vertical-forest-being-built-stefano-boeri-lausanne-switzerland.html

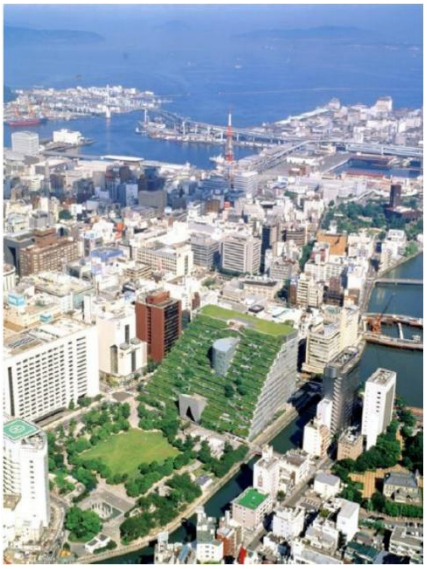
An urban forest is growing in Milan, Italy. See https://urnabios.com/discover-vertical-forest-bosco-verticale/

Bosco Verticale is a pair of residential apartment towers that constructed in the centre of the city. Upon completion, the Stefano Boeri-designed buildings were the world's first vertical forest.

The "green" high rise complex, which consists of two 285-feet (18 floors) and 290-feet (26 floors) high structures, features massive reinforced concrete balconies with lush trees and shrubs. A total of 120 large and 544 medium-sized trees, and more than 4,000 shrubs and bushes are planted on the façade from top to bottom. On flat land, each "vertical forest" is the equivalent, in number of trees, to 10,000 square metres of forest.

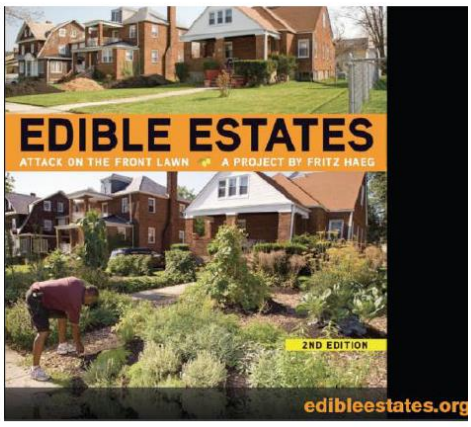
The vegetation will take on the important functions of a forest: reducing carbon dioxide levels while simultaneously producing oxygen. The planted areas will also provide residents with protection against noise and dust. In summer, the treetops will shade the apartment units against direct sunlight; in winter, they will allow the rays from the low-lying sun through, thereby regulating the climate during all seasons. A reduction in humidity and effective wind protection is also expected.

One of the things we are not in short supply of is options for consideration as part of the solution! The picture of the ACROS Prefectural Hall shown here is to me, an incredible example of the types of solutions we should be embracing post haste and clearly some are. The solution, of course, must include a thorough and balanced understanding of the challenges we need to address and especially how to practically address them. For example, as fantastic of solution as the ACROS appears to be, it is not remotely practical to think we can replace much more than our normal 1% of building inventory per year. This applies for not only commercial buildings but suburban residential houses as well.

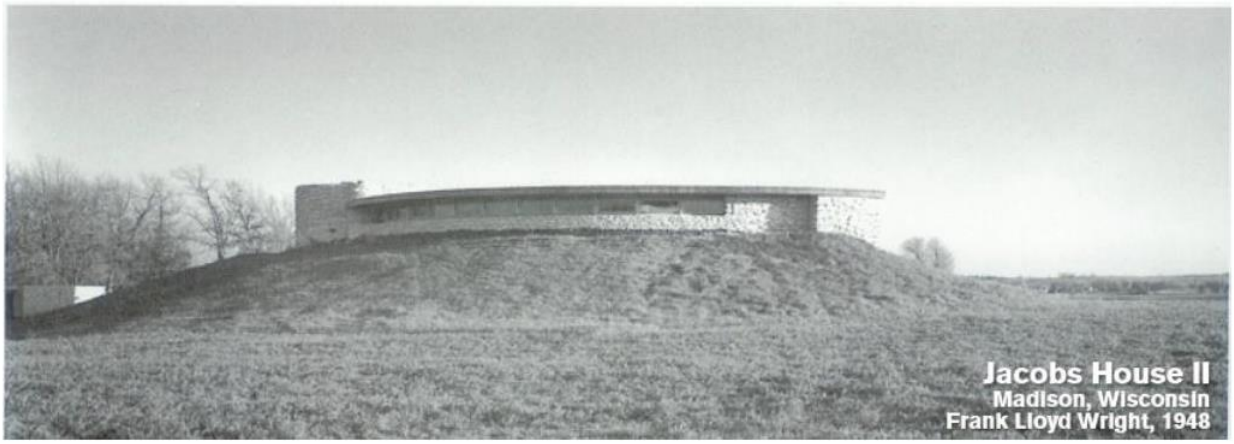


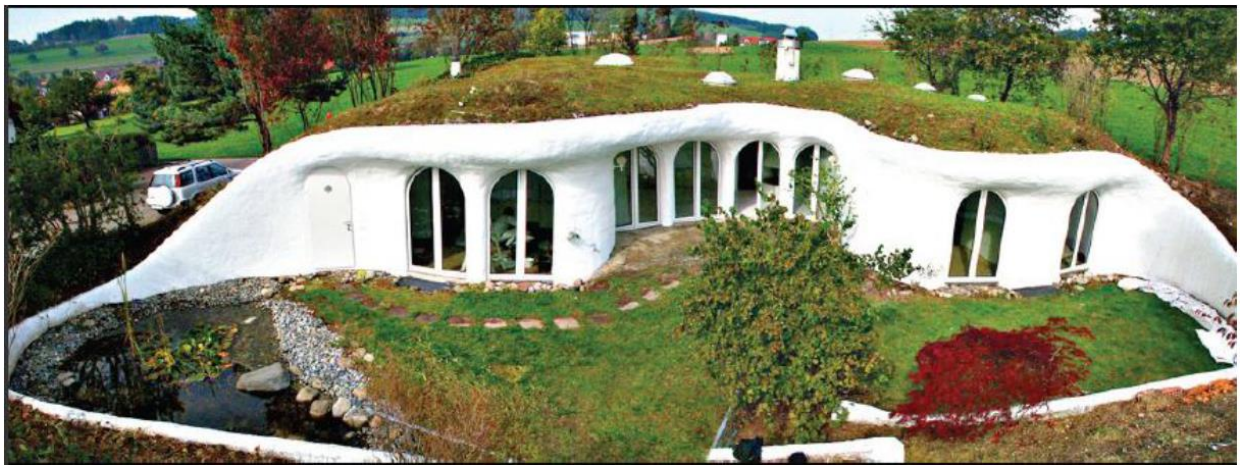
Very much part of understanding the problem is understanding why change and adapting solutions is slow and often difficult as the next pictures of single family residence illustrates it to be, when as influential of figure as Floyd Lloyd Wright put forward this solution all the way back in 1948.

Poor: **Better:**

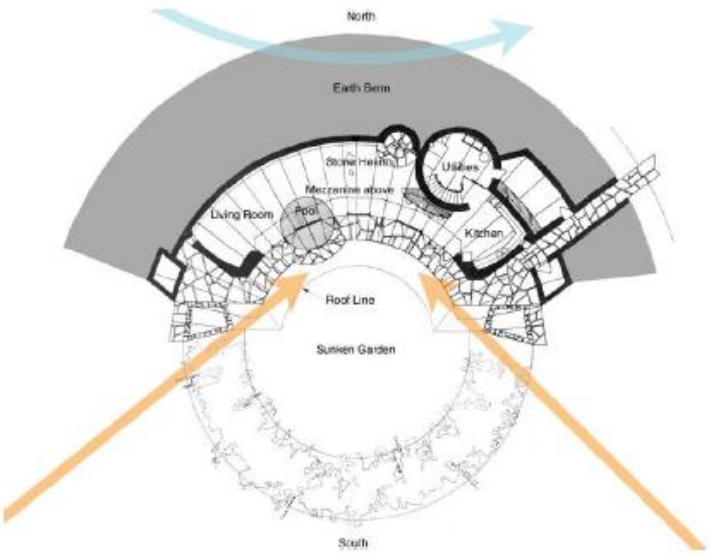


Best (if it also had an edible landscape):





South face



North face

The population of ancient Athens coped with the increasing depletion of wood by taking advantage of solar energy to save charcoal during the winter. Excavations of two middle fifth century B.C. houses suggest that passive solar design developed into a common way of building. Each structure had an open court at its southern end with the main room to the north of the open court and facing toward it. The southern orientation allowed the low winter sun to penetrate the main room. Socrates was an early solar advocate and probably passed many a pleasant winter day or evening in such a house.

To help heat houses without recourse to scarce wood-based fuel, Aristotle suggested the following method already in vogue in Athens. “For the comfort of inhabitants,” Aristotle advocated, “the house must be sunny in winter and well sheltered from the north”. In the fourth century B.C. the adoption of passive solar design spread to many sections of the Greek world and interest

in it continued unabated for several centuries to come. Entire cities, such as the city of Priene, were planned so that every citizen could leverage solar heat.

First, urban planners laid out Priene's streets in a checkerboard pattern despite its hilly location. Its major streets ran east west so every house would have a southern exposure. Then all houses at Priene, no matter what size, were designed according to what the excavator of Priene called "the solar building principle."

Saskatchewan Conservation House in 1977 was the first Passive House in the world but then energy returned to being cheap and we were lulled back into being inefficient. How many times have we replayed that movie?

http://sfglobe.com/2015/11/11/family-designs-glass-green-house-to-wrap-around-home-and-warm-it-naturally/

http://www.theglobeandmail.com/life/home-and-garden/gardening/from-montreal-to-finland-residential-greenhouses-are-on-the-rise/article27297824/

'It’s a funky off-grid house:' Take a tour of Alberta's first official earthship


Annalise Klingbeil, Calgary Herald
More from Annalise Klingbeil, Calgary Herald

Published on: June 6, 2015 | Last Updated: June 6, 2015 7:00 AM MDT

LETHBRIDGE COUNTY — In the dead of winter, in the middle of the southern Alberta prairies, the Kinneys’ Christmas dinner included juicy tomatoes freshly picked from the family’s new home.

Producing vegetables even when there’s snow on the ground isn’t the only feature that makes the Kinneys’ abode unusual.

Made of 800 recycled tires and 12,000 cans encased in mortar, the long and skinny bungalow is a radically sustainable building that offers all the comforts of a modern home without any electricity or water bills.

The dwelling has running water, flush toilets, a washer and dryer, a television and Internet.

More impressively, the off-grid structure grows its own food, treats and recycles its grey water, generates its own electricity, and regulates its temperature, whether the mercury outside is hovering around -30 C or 35.

Located north of Lethbridge, past rolling prairies in a stunning scenic valley, the couple’s retirement home is Alberta’s first official earthship.

“When people first hear the word (earthship), they think hippie-dippie tinfoil hat type things,” said co-owner Glen Kinney. “Once you explain it they start to get the idea. It’s sustainable.”

Constructed during the summer of 2014, the home blends into the barren natural environment and faces south for maximum sun exposure to best charge the building’s solar power system.

The front of the structure is covered in large glass windows and a greenhouse runs the length of the front wall, serving as a main hallway and air barrier between the living space and the outdoors.

The greenhouse inside the Kinney earthship produces vegetables year-round and runs the length of the home’s front wall. The greenhouse also produces vegetables year-round, including those tasty tomatoes the Kinney family enjoyed while spending Christmas at their newly built earthship.

Insulation and sunlight mean the home stays warm in the winter, while earth tubes and ceiling vents keep it cool in the summer.

Rainwater is caught by the metal roof and collected, treated, and filtered down into the home where it’s ready to drink.

The earthship reuses all household sewage in indoor and outdoor treatment cells for food production and landscaping, without polluting aquifers, says a website describing typical design features. Toilets flush with non-stinky grey water.

The house produces its own electricity with a photovoltaic/wind power system. The energy is stored in batteries.

Kinney and his wife spent five weeks building the earthship with help from their adult children, volunteers from around the world, and a paid crew of 13 people from Earthship Biotecture last summer.

Volunteers, a paid crew, and family members helped the Kinney family build their earthship on rural land near Lethbridge during the summer of 2014. Duncan Kinney / for the Calgary Herald

Michael Reynolds, founder of Earthship Biotecture and the inventor of earthships, attended the build. It marked the first time an official Earthship Biotecture-built structure was constructed in Alberta.

“What these buildings exemplify is that it’s entirely possible to have everything you need in luxury — flat screen TV, high-speed Internet, everything — without spending a dime and certainly without hurting the planet,” Reynolds said when he was in Alberta during a July interview with the Herald.

The American architect coined the term earthship more than two decades ago, a name he picked because like a ship, the homes are fully independent vessels.

The alternative housing form has evolved over the years and became better known following a 2007 documentary about Reynolds and his “green disciples” called Garbage Warrior.

From the outside, the Kinney home is reminiscent of a dwelling a hobbit might live in.

But inside, the radical residence looks like something out of the pages of a rustic home decor magazine.

A bedroom inside the Kinney earthship. Christina Ryan / Calgary Herald

The earthship contains three bedrooms, two bathrooms, a kitchen and a cosy living room.

Building the skinny bungalow cost the same as what a similar-sized structure in Calgary would have cost, according to Kinney.

“It’s a funky off-grid home,” said Kinney’s adult son Duncan, who lives in Edmonton.

“It’s a really great space. It’s fun to visit. It’s refreshing to visit. I’m excited to drive five hours to get to it.”

Take a tour of Alberta's first official earthship

Made of 800 recycled tires and 12,000 beer cans encased in mortar, the Kinney earthship is a radically sustainable building that offers all the comforts of a modern home without any electricity or water bills.

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  The Kinney family's earthship on rural land near Lethbridge was photographed in March 2015. Christina Ryan / Calgary Herald

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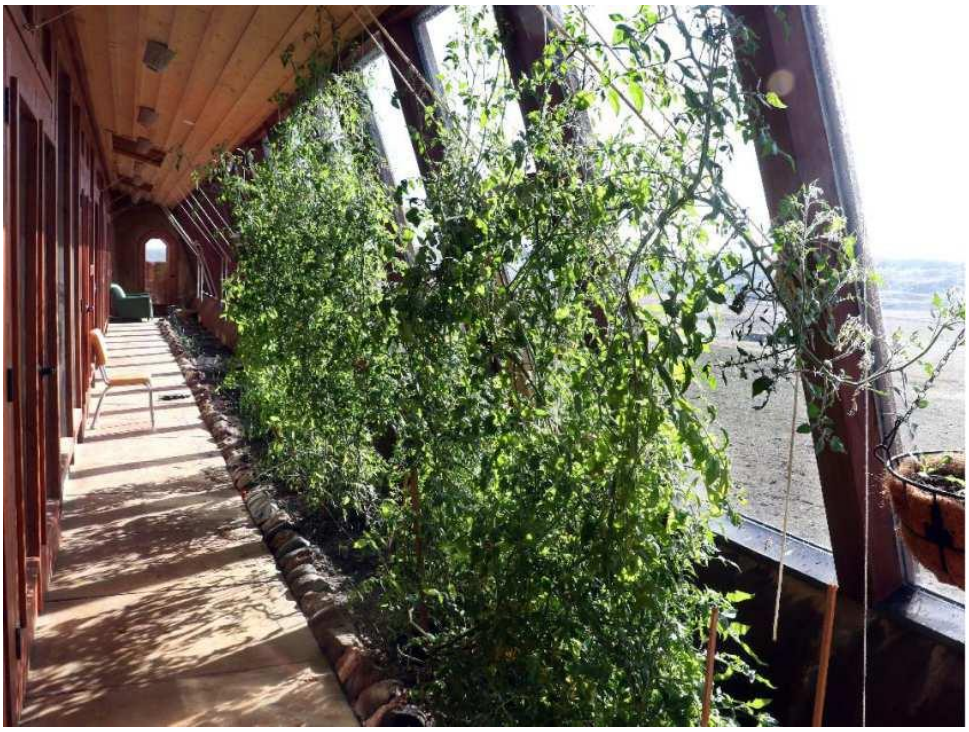
  The entryway of the Kinney earthship. Christina Ryan / Calgary Herald

Looking into the Kinney earthship's long greenhouse, which serves as a main hallway and air barrier between the living space and the outdoors. It also produces vegetables year round. Christina Ryan / Calgary Herald

- 

  The Kinney greenhouse. Christina Ryan / Calgary Herald

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  A bathroom inside the Kinney earthship Christina Ryan / Calgary Herald

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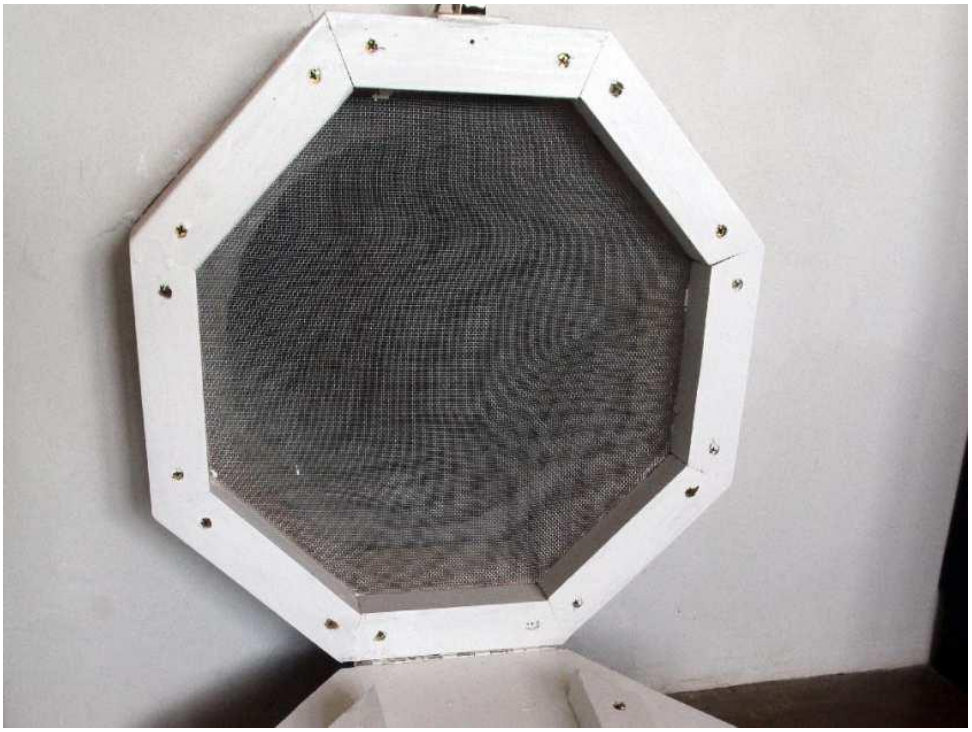
  The structure's living room. Christina Ryan / Calgary Herald

- The earthship kitchen. Christina Ryan / Calgary Herald



- Earth tubes and ceiling vents keep the home cool in the summer. Christina Ryan / Calgary Herald

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The Kinney earthship. Christina Ryan / Calgary Herald

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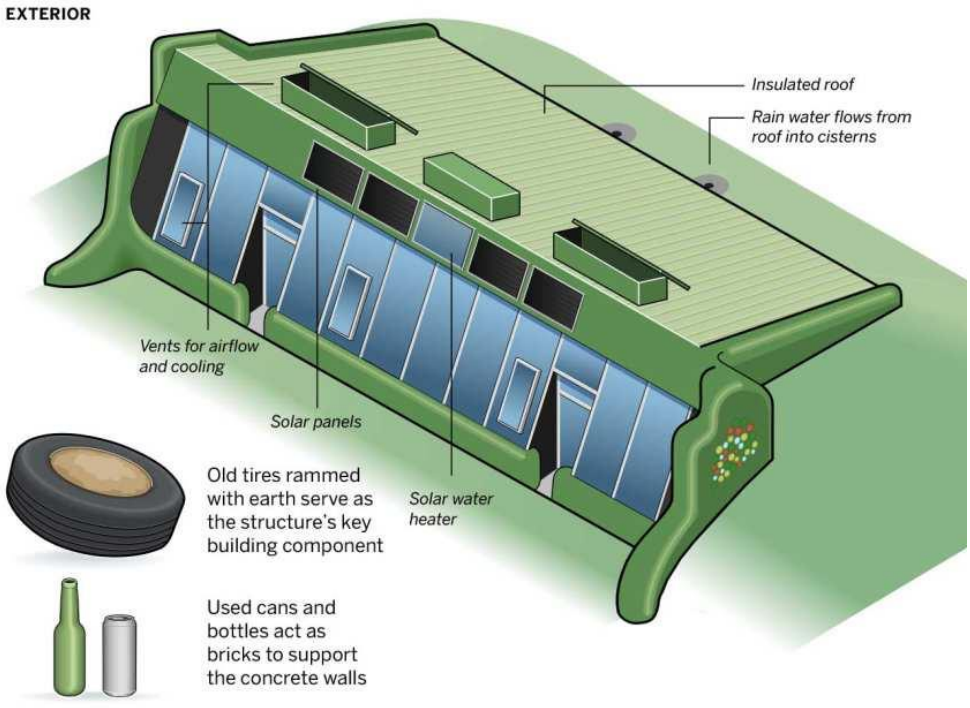
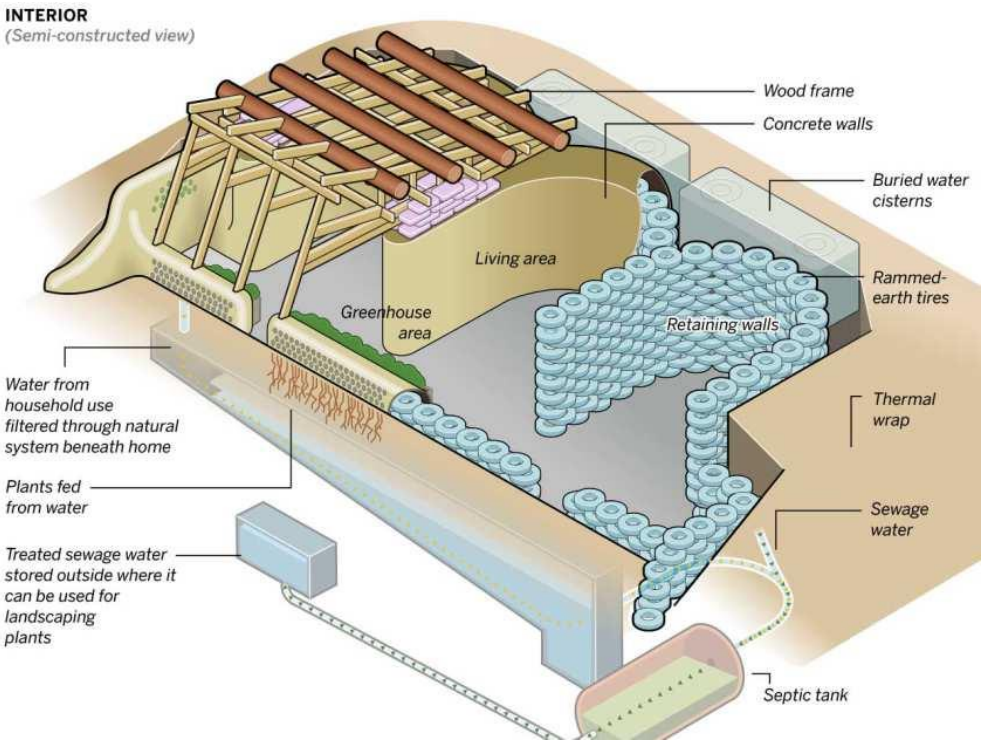
The Kinney earthship. Christina Ryan / Calgary Herald





Kinney was introduced to the alternative housing concept several years ago by his son, who read about earthships in a book by Calgary journalist Chris Turner.

Like many converts, the father-son duo volunteered on other earthship builds and gained first-hand experience before undertaking a project of their own.

The Kinney family got the plans for their earthship from Global Model but made a few modifications. And while there is still some furnishing, finishing and tweaks needed, Kinney said he's already impressed with the 2,000-square-foot finished product.

“We like what we’ve got,” he said. “It works good.”

The family’s unusual green abode has attracted plenty of attention — when the Kinneys hosted an open house in the summer before the earthship was finished, hundreds of people came to marvel at the structure’s systems and ask questions.

“Earthships can inspire a lot of interest and ours certainly fell into that category,” said Duncan, who is looking forward to many more Christmas dinners in his family’s sustainable abode.

“It’s a nice back-pocket fantasy to have I’ll go and get a spot of land and build an earthship and live off-grid. It scratches a lot of itches for a lot of different people.”

Suitable housing as an obstacle to sustainable consumption

Housing (whether one is purchasing or renting) is typically life’s largest expense, so it is no surprise that most find it to be their greatest obstacle to consuming more sustainably, in no small part to how few options are available. One way to think of sustainable housing is in the context of ‘eco-design’, but the fact is that often these types of houses, despite having all the eco-features (recycled materials, solar panels, multi-glazed windows, etc.) end up being so expensive and seldom readily available, that only the privileged few can afford them. Furthermore, it is noted, that living close to work can reduce one’s dependency on cars, but if it means living in the inner city, this means expensive housing, most often in high rises, with all too little ability to grow food. We may have some conception of what a sustainable house looks like – e.g. a small energy efficient straw bale house, built from local materials, which is close to work and public transport and has access to a community garden (from which in Canada you likely would grown something like 1% of your food) – but currently this is not an easy option to choose.

A little North American housing industry history and predicting the future

Prior to the Great Depression, the housing industry employed 30 percent of Americans. But in 1929 it collapsed. The total number of housing starts across the US in that year amounted to only 5 percent of the 1928 figure. In addition, by 1930 there were 150,000 nonfarm foreclosures, more than double the pre-Depression rate. These foreclosures increased by about 50,000 homes each year until 1933, when half of all home mortgages in the United States were in default. More than a thousand urban residential foreclosures occurred every day. Throughout America, the homeless and unemployed collected in so called tent cities, hobo jungles and Hoover Heights.

World War II improved the situation greatly, as 16 million young service men and women shipped out to the European and Pacific theaters. But this improvement was only temporary. After demobilization, the situation worsened again. For example, in Chicago in 1946, the housing crisis was so bad that over 100,000 (veterans mostly) unemployed young men were homeless. In their book Picture Windows: How the Suburbs Happened, Rosalyn Baxandall and Elizabeth Ewen eloquently illustrate just how acute the housing crisis had become.

“In 1933, under FDR, the federal government responded to the crisis with a series of experimental moves that would ultimately render old techniques and styles of housing construction obsolete. The Home Owner's Loan Corporation refinanced thousands of loans in immediate danger of default and foreclosure. HOLC also granted low-interest loans that enabled some homeowners to recover lost property. Their major innovation, however, was the introduction of long-term self-amortizing mortgages with uniform payments spread over the life of the debt. This development was to have a remarkable effect on American real estate after 1944, when section 505 of The Serviceman's Readjustment Act (the GI Bill) guaranteed every veteran a fully financed mortgage for any home meeting FHA standards. Then in 1947, the Housing and Rent Act introduced rent controls to keep rental housing affordable. One consequence of this act was to make rental properties much less lucrative for investors, who turned their capital and energies to the construction and sale of privately owned homes.”

On the outer rings of cities where land was cheaper, suburban developments sprang up almost overnight, aimed at a new blue-collar mass market. Houses in this new suburbia were pared down to their most essential features, as developers found ways to economize on construction.

http://www.theglobeandmail.com/news/british-columbia/vancouver-house-buying-frenzy-leaves-half-empty-neighbourhoods/article27056534/

http://www.bloomberg.com/news/articles/2015-11-05/share-of-first-time-homebuyers-falls-in-u-s-now-at-28-year-low

Why Americans are fleeing the suburbs

Single-family homebuilding is at its lowest rate in decades, as only 600,000 single-family homes were built in 2013, down from 1.7 million in 2005. The purchasing of single-family homes is also down 13.3% year-over-year. High-rise apartment buildings now make up 40% of all new construction and metro areas are growing more quickly than the U.S. as a whole. According to The Nielsen Group, 62% of millennials would prefer to live in urban centers – but are these high rises energy traps or sustainable?

https://www.theglobeandmail.com/business/economy/article-how-canadas-suburban-dream-became-a-debt-filled-nightmare/

Ghost Houses Spread in Tokyo's Aging Suburbs New York Times International Weekly Aug 29, 2015

"Despite a national aversion to waste, discarded homes are spreading across Japan like a blight in a garden. Some eight million dwellings are now unoccupied, according to a government count. Nearly half have been forsaken completely – neither for sale or rent…

Many of Japan's vacant houses have been inherited by people who see no use for them and yet are unable to sell…The vacant house phenomenon is spreading through regional cities and suburbs of major metropolises…

Today the young workers of the postwar years are retirees, and few people, their children included, want to take over their homes. "Their kids are in modern high-rises in central Tokyo," said Tomohiko Makino, a real estate expert who has studied the vacant home phenomenon. "To them, the family home is a burden, not an asset."

The city of Yokosuka is encouraging owners of abandoned houses to list on an online "vacant home bank" to showcase houses that real estate agents will not touch. But just one has been sold so far, a 60-year-old single-story wooden home that was listed for 660,000 yen or $5,400 USD. Places farther up the hill can be had for the equivalent of just a few hundred dollars."

In 2003, the average suburban U.S. household spent $1,422 a year on gasoline, according to the Bureau of Labour Statistics. By April 2008 – when gas prices went to $3.60 a gallon – the same household was buying gas at a rate of $3,196 a year and of course this does not include car wear and tear, insurance costs and so forth.

Calgarians spending too much time, money commuting

By Mario Toneguzzi, Calgary Herald August 24, 2011 9:36 AM

CALGARY — The average Canadian worker is spending 42 minutes commuting to and from work each day and $269 each month on associated costs of working away from home, says a national survey.

The survey by Workopolis said the largest cost is transportation at $146 a month.

Time and money spent as a result of travelling to work is the equivalent of 186 hours and more than $3,000 each year.

"We spend a lot of time and money getting to and from work each day — not to mention the environmental strain and stress that comes with commuting," said Kelly Dixon, president of Workopolis, in a news release. "Today, working from home is a viable option for many. We need to continue to promote the benefits of telecommuting and encourage more flexible working arrangements for Canadian workers." Today, many employers after the pandemic want their worker back in the office for many reasons

The survey for Calgary said 69 per cent of workers commute by car on their own; 19 per cent take public transit; 10 per cent carpool; 12 per cent walk; and four per cent ride a bicycle.

Workopolis says only 38 per cent of Canadian workers work from home a few days per month even though "many companies have the capability through emerging and secure technologies and practices to offer this as an option to their employees."

"Offering the option of working from home can also help to position a company as an employer of choice. In fact, seven in 10 (68 per cent) of respondents indicated they have turned down a job prospect just to avoid a long commute," says Workopolis.

The survey said 58 per cent said they would spend the extra time working more hours. This number is even higher for those Canadians who are already working from home some of the time (73 per cent).

Meanwhile, Statistics Canada reported that Canadian commuters took an average of 26 minutes to travel to work on a typical day in 2010, including all modes of transportation. The average commuting time was longest in the six largest census metropolitan areas, each of which has a population of more than one million.

Commuters in these metropolitan areas spent 30 minutes on average getting to work. Those in mid-sized metropolitan areas of between 250,000 and fewer than one million people took 25 minutes, added the federal agency.

The average commuting time was longest for commuters in the CMAs of Toronto, 33 minutes, Montréal, 31 minutes and Vancouver, 30 minutes. In the Calgary area, the average was 26 minutes and 16 per cent of commuters took 45 minutes or more to get to work.

Statistics Canada said about 82 per cent of commuters in the country travelled to work by car in 2010, while 12 per cent took public transit and six per cent walked or bicycled.

“The connection between commuting times and stress was clear. Of the full-time workers who took 45 minutes or more to travel to work, 36 per cent said that most days were quite or extremely stressful. In contrast, this was the case for 23 per cent of workers whose commuting time was less than 15 minutes,” said Statistics Canada.

Read more:
http://www.calgaryherald.com/business/Calgarians+spending+much+time+money+commuting/5299228/story.html#ixzz1VxmgXoxA

“Gasoline already overtook grocery spending for low-income families in 2008, when prices surged to $4 a gallon, and it will do the same for even average-income Americans in the future” says Jeff Rubin.

Income will obviously play a huge role in determining who stays on the road and who gets off, but where you live will also count. While 75% of all Europeans living in cities have access to some form of public transit, only 50% of American households living in the suburbs have similar access. While 60% of American households have a car only 30% of British households do. Whereas over 90% of Americans drive to work, only 60% of Brits do. In 1970, the average American car was driven only 9,500 miles per year. By the time the new millennium, it was driven over 12,000 miles.

As technology allowed the cost of flying to fall despite higher fuel costs, more people started to fly. Overall fuel consumption in aviation has risen by 150% in the United States. The price of jet fuel in the United States rose from $12.04 per million Btu in 2017 to $15.69 per million Btu in 2018, a 30% increase. U.S. jet fuel expenditures rose from $42 billion in 2017 to $55 billion in 2018, a 32% increase. (Source: The latest 2018 estimates have been incorporated into the time-series data files in the Data Files section on the SEDS Updates page. These data files also now feature the recently released SEDS key statistics and indicators, which can also be found on the SEDS complete 2017 page.)

Energy demand grew by 2.1% in 2017 and fossil fuels met over 70% of this growth. With growth in shipping, trucking and aviation, demand is projected to rise to 105 million barrels a day.

Improvements in thermal insulation and in the energy efficiency of major household appliances, especially energy sucking furnace and air-conditioners, have helped to make major gains in energy efficiency in the home. Whereas the average air-conditioner is 17 percent more efficient than it was in 1990, the number of air conditioners in American homes is up 36%, as what was once considered a luxury item has become a standard feature across North America.

Since 1950, the average American home has grown from 1,000 square feet to almost 2,500 square feet today. That’s two and a half times bigger. We are certainly not two and a half times more efficient. Again, we can hear the echo what is often called the rebound effect or Javon’s Paradox. The average Australian home is about the same size, and homes in Canada and New Zealand are just slightly smaller. The average home in the UK or Germany is about one-third as big. As energy costs head strongly back up, are Canadian’s headed to 2,500 square feet in the suburbs or back to 1,000 square feet as close to work as possible?

Low oil prices in the 1990’s lulled auto makers and suburbia real estate developers into disastrous complacency; they had few efficient models available when oil and energy turned expensive. For decades, the saw blade of high and then low energy prices has led to a jerky, stop and start affair in product design and what consumers were looking for. Complacency is the smother of all innovation.

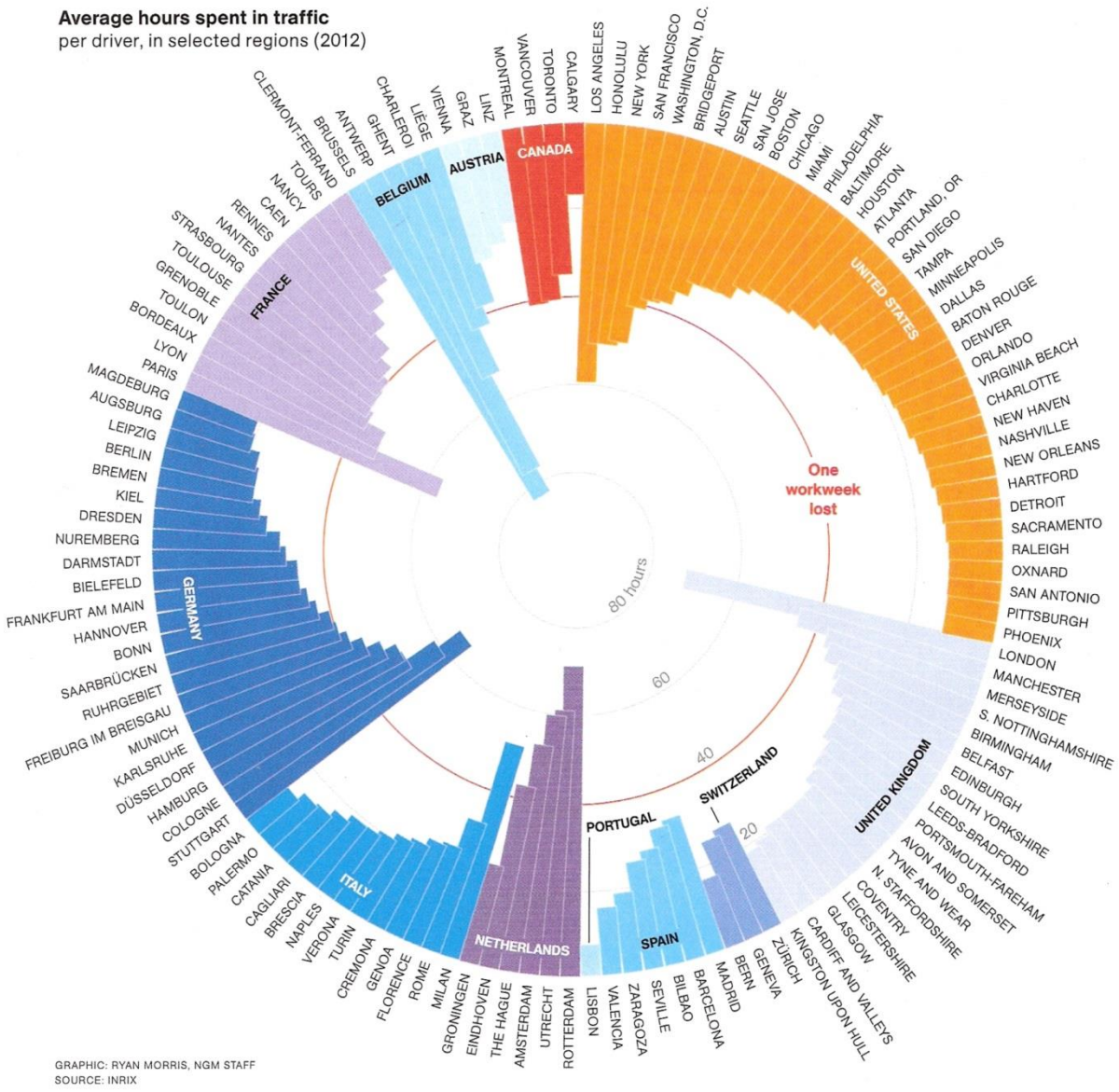
http://www.citylab.com/housing/2015/06/every-single-county-in-america-is-facing-an-affordable-housing-crisis/396284/

Commuter Science

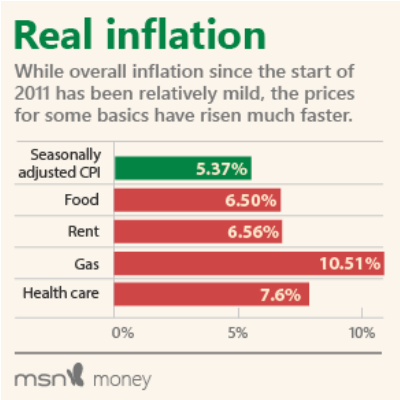
By 8 a.m., rush hour is at full throttle in most cities. Accidents, the cost of fuel, and the quality of public transportation aren't the only factors that can make the drive to work range from ho-hum to hellish. According to traffic analyst Jim Bak, there's another thing that can cause commuting lengths to fluctuate: the state of the economy.

"When the recession hit in 2008, congestion across the U.S. dropped 30 percent," he says. Four years later, in 2012, drivers in Italy, France, and Spain also spent less time on the road as unemployment, especially among youth, skyrocketed in the wake of Europe's debt crisis. That same year, European Union officials tasked with managing the problem flocked to Brussels, Belgium—causing traffic and commute times in that city to soar. *—Catherine Zuckerman*

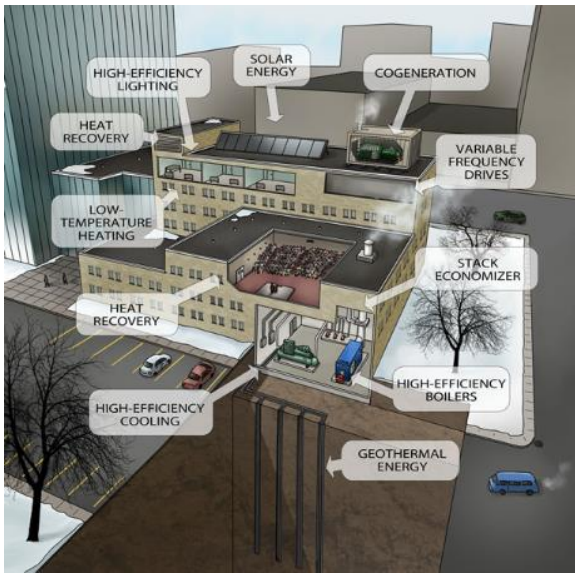
Average hours spent in traffic
per driver, in selected regions (2012)



GRAPHIC: RYAN MORRIS, NGM STAFF
SOURCE: INRIX



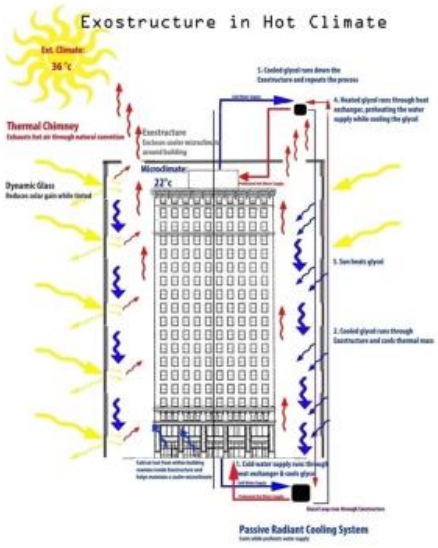
Contrary to what the drill-here, drill-now crowd says, oil and gas companies could punch holes in every inch of resource producing property and barely make a dent in prices if we look beyond short-term trends to longer term trends. Even a more energy independent North America cannot control prices, not with a thirsty developing world competing in an increasingly globalized market with planned LNG to somewhat globalize natural gas prices for North America. The oil and gas used may, at best, be North American, but it does not mean it will be cheap. This is the future of oil and natural gas: as costly as it is polluting. But if we cannot ensure cheap oil or natural gas, we can become more resilient for when energy becomes more expensive. The catch is that consumers will only buy if that story prevails over stories of "100 years" of cheap energy, plentiful renewables and if 'price head fakes' become less pervasive. How many bought the 'high energy price story is here to stay' and subsequently bought into a fixed price energy contract or premium priced Prius or high efficiency solar panelled house, only to wonder about having paid the premium as energy once more swooned?

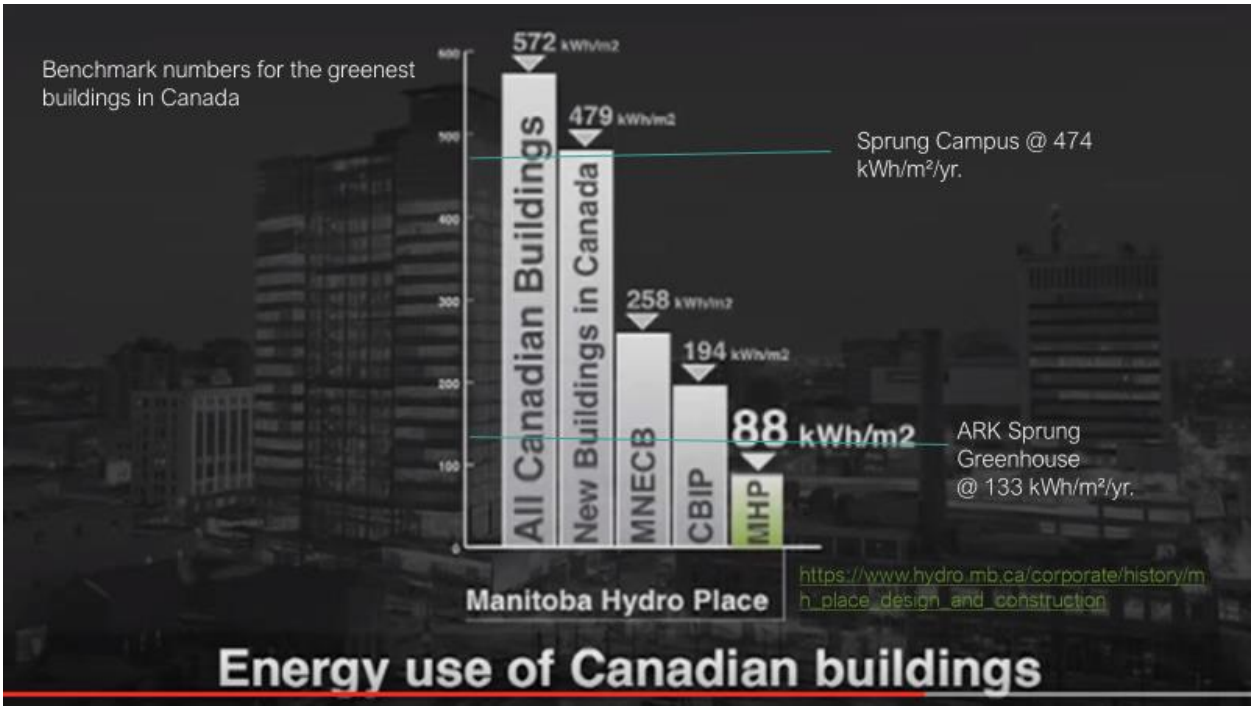


Unfortunately, the best energy efficiency solutions have had to be designed that way from scratch. ACROS, Manitoba Hydro's head office or Alberta's first earth ship or first net zero office http://www.theglobeandmail.com/report-on-business/industry-news/property-report/taking-net-zero-energy-performance-to-the-office/article24139667/ are fantastic examples of what is needed, but as I say, rebuilding everything isn't remotely practical or at all environmentally responsible. Reskinning and retrofitting will the order of the day. A great deal needs to be undertaken in this area and to a degree is being undertaken as depicted above for commercial buildings. The resources on these subjects (whether it be re-skinning, retrofitting for energy efficiency or edible water conserving landscapes) are vast and readily available so we will not repeat them here. Rather we will focus solely on something we see as quite proven, but all too often overlooked. We will call this unique and valuable solution 'the passive solar advantage', captured in several ways by Floyd Lloyd Wright's approach, which he in turn is said to have adopted from home designs of Socrates time.

The big roof ambition recalls Buckminster Fuller's 1960 scheme to cover Manhattan with a geodesic dome, or Richard Rogers' 1994 plan to swamp London's Southbank Centre with an enormous undulating tent, and the whole sweep-it-under-one-big-roof idea has a decidedly retro air.

Here is Manitoba Hydro's best practice setting approach to cold climate building energy efficiency.





The following is pictures of such buildings already proving the concept:

Manitoba Hydro's head office opened in 2009, it sits a few blocks away from the corner of Portage and Main, long held out as one of the coldest locations in Canada, and yet its nine boilers, installed at the insistence of change adverse and ultra conservative mechanical engineers. Since 2009, they have never had more than one boiler come on and never for more than cumulatively three weeks in a year. The secret is part geothermal heating and the other part a passive solar tower on the south side of the building. Geothermal, of course, is not much of a secret, albeit effective implementation seems to be. Retrofitting existing buildings is not easy either, although we know of a hotel in Toronto faced with no available footprint for bore holes, who solved the issue with a special permit from the city to bore especially large holes in the cities alleyway, which is about all we need to say to highlight the existing possible opportunity for a great many retrofits. Albeit an expensive retrofit, with then about a 14+ year simple payback, which all too seldom gets approved.

The solar chimney or tower is the unique feature, as we know of no other building in North America currently deploying this. To achieve a high level of energy efficiency while maintaining occupant comfort, Manitoba Hydro Place maximizes the use of passive energy technologies while minimizing the use of active energy systems.

Passive systems (i.e. south-facing winter gardens, natural daylighting and the solar chimney/greenhouse) take advantage of the environment and natural processes to reduce energy usage. Active systems (i.e., dimmable, programmable fluorescent lighting) help maximize the effectiveness of passive systems and supplement them as required.

The solar chimney, a 115-metre-high column rises above the top of the building. It is key to the passive ventilation system of Manitoba Hydro Place, relying on the natural "stack effect" of a chimney, essentially a type of greenhouse, to create a draw of air out of the building.

In winter, exhaust air is drawn to the bottom of the solar chimney. Heat recovered from this exhaust air is used to warm the parkade and to preheat the incoming cold air in the south winter gardens. In summer months, warm air is exhausted directly out of the solar chimney.

Fresh air is drawn into one of the three 6-storey or the single 2-storey atria (winter gardens) on the south side of the building. Water features in each winter garden provide humidification/ dehumidification of the fresh air, while waste heat recovered from the exhaust air and natural solar energy warm the fresh air.

The south winter gardens act as lungs, providing preconditioned fresh air to the building via the raised floor system.

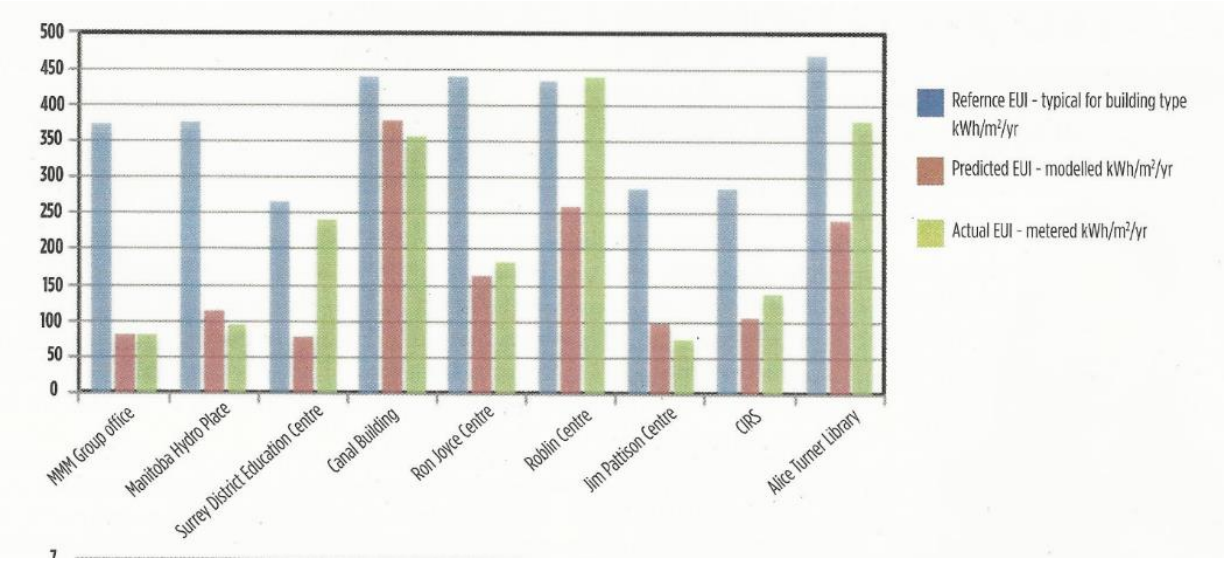
This preconditioned air enters workspaces through vents in the raised floors. Occupants and other sources of heat will cause the air to rise toward the ceiling. This system supplies the office space with 100 per cent fresh air, 24 hours a day, year-round, unlike a conventional building where air is recirculated.

The air rises to the ceiling and flows to the north end of the building, where it is exhausted passively by the solar chimney.

Natural ventilation minimizes the need for a forced air mechanical circulation system.

In the intermediate seasons (spring and fall), the mechanical ventilation systems will be turned off and the building is ventilated by opening windows.

- See a diagram of airflow - spring/fall operation.
- See a diagram of airflow - winter operation.
- See energy features - an external overview.
- See energy features of the lobby.
- See energy features of the atrium.



We think though that Manitoba Hydro could have even further improved their system by deploying cogeneration and district energy solutions. This would have aided surrounding buildings, helping them achieve vastly higher energy efficiency and maximize the electricity available for export, which is very much Manitoba Hydro's specialty.

So here we have a building since 2009, proving the effectiveness of a passive solar greenhouse to condition a large office space in a cold northern climate. In Manitoba Hydro's case, the approach is with glass and which is not an inexpensive construction materials. However, the approach has been proven since the 1970's for greenhouses, also in northern climates, using other construction materials such as specialized membranes and aluminum. Take the Eden project by way of another example.

The Eden project is located in a reclaimed Kaolinite mine pit. At the bottom of the pit are two covered biomes:

The Tropical Biome, covers 1.56 hectares (3.9 acres) and measures 55 metres (180 ft) high, 100 metres (328 ft) wide and 200 metres (656 ft) long. It is used for tropical plants, such as fruiting banana trees, coffee, rubber and giant bamboo, and is kept at a tropical temperature and moisture level.

The Mediterranean Biome covers 0.654 hectares (1.6 acres) and measures 35 metres (115 ft) high, 65 metres (213 ft) wide and 135 metres (443 ft) long. It houses familiar warm temperate and arid plants such as olives and grape vines and various sculptures.

The covered biomes are constructed from a tubular steel (hex-tri-hex) with mostly hexagonal external cladding panels made from the thermoplastic ETFE. Glass was avoided due to its weight and potential dangers. The cladding panels themselves are created from several layers of thin UV-transparent ETFE film, which are sealed around their perimeter and inflated to create a large cushion. The resulting cushion acts as a thermal blanket to the structure. The ETFE material is resistant to most stains, which simply wash off in the rain. If required, cleaning can be performed by abseilers. Although the ETFE is susceptible to punctures, these can be easily fixed with ETFE tape. The structure is completely self-supporting, with no internal supports, and takes the form of a geodesic structure. The panels vary in size up to 9 metres (29.5 ft) across, with the largest at the top of the structure.

The ETFE technology was supplied and installed by the firm Vector Foiltec, which is also responsible for ongoing maintenance of the cladding

http://architecture.mit.edu/pdfs/lecturereadings/Transsolar_Introduction.pdf

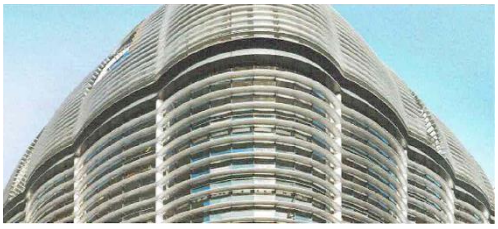
https://www.youtube.com/watch?v=0pkElk4xCgQ&feature=youtu.be

https://www.youtube.com/watch?v=p2RIZkLT1uo&feature=youtu.be

But aren't such greenhouses inherently energy hogs? If heated and cooled conventionally, yes, but if one uses passive solar techniques developed and used in greenhouses the world over since the 1970's – then no. Even in cold northern climates they have been proven to need supplemental heat, perhaps from biomass they produce themselves, up to about 40% of the year and sometimes not at all.

Building a new building is often quoted at about $200/sq. ft. Greenhouse structures of many types are often quoted at about $50-120/sq. ft. Cost effective, energy efficient re-skinning, with the advantage of local food production strikes us an opportunity. Would you fly south, when you might cross country ski outside the front door and enjoy the tropics out the back door? Might we dome multiple houses to re-invigorate a suburb and create local food production employment? I could go on and I'd like to. We are limited only by our imagination. I highlight this just to highlight the possible types of solutions, if we recognize the root energy problems we need to solve for, the urgency to do so and so begin to think outside the box. But not too far out of the box or bleeding edge as the below shows there are a good number of wonderful examples having proven what is feasible for years:

Outside and inside IBM's World 1984 Expo membrane pavilion in Milan:



As the 2011 book Construction Manual for Polymers + Membranes states "The light permeability of materials is an important design element and in the case of synthetic materials can often be adjusted across a wide range. Polymers/membranes are the only materials that allow the creation of vast open spans but at the same time light-permeable structures." Biopolymers are also making headway.

"Solar radiation penetrates a building material that is essentially transparent (greenhouse effect)…The heat radiation cannot leave the space again through the transparent building material through which the solar radiation originally entered because this material is not transparent for the long-wave for infrared radiation…The outcome is that during daylight hours, interiors with such enclosing transparent surfaces are heated. This phenomenon can be intentionally exploited in the form of passive solar gains." Automated interior heat curtains can maximize R-values at night and are commonplace in commercial greenhouses in certain regions.

“As the operating phase of a building accounts for 75% of the total life cycle assessment (LCA), improved functional performance leads directly to a marked reduction in the environmental impact of the building. Needing less energy (lighting and thermally) might therefore be more effective than the savings realised through other measures. When used for insulation and energy generation in a building envelope, transparent and translucent polymers have an especially positive effect on the overall LCA”. As well as esthetics and multi-function capacities, such as local food production, as we believe previous and the following photos show.

The Wallbrook office and retail development completed in London in 2009 by architects Foster + Partners

The refurbishment and conversion of Dresden Germany’s main railway station completed in 2006 by architects Foster + Partners.

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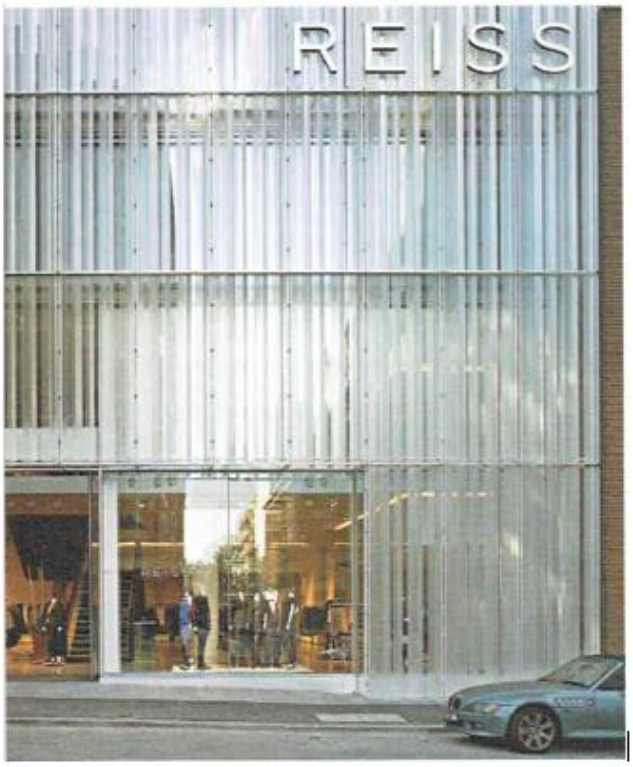
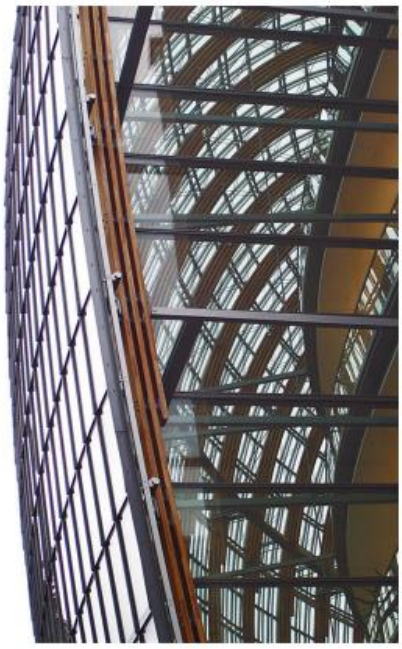
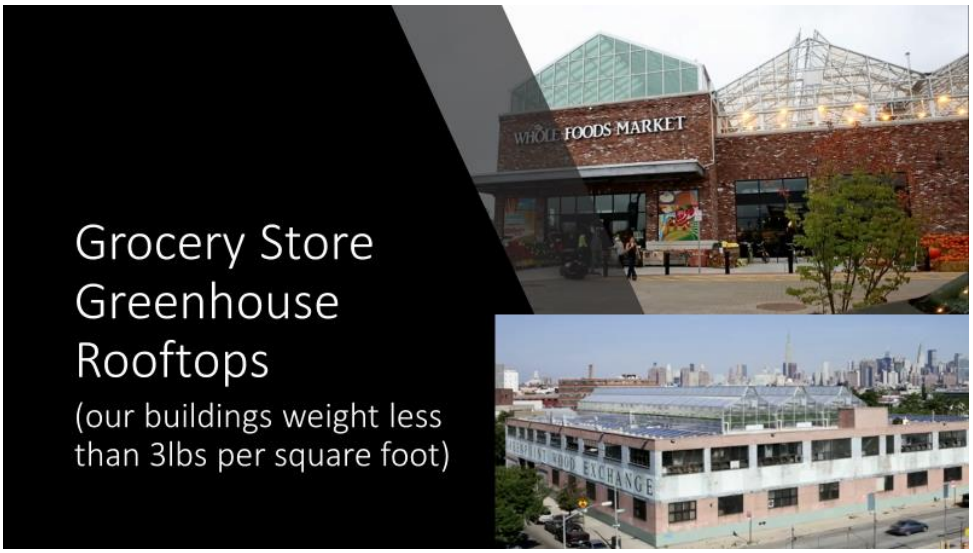
Shenzhen International Airport – Dr. Jan Knippers



The Reiss flagship store and headquarters completed in London in 2008 by architects Squire + Partners



Weltstadthaus, Cologne



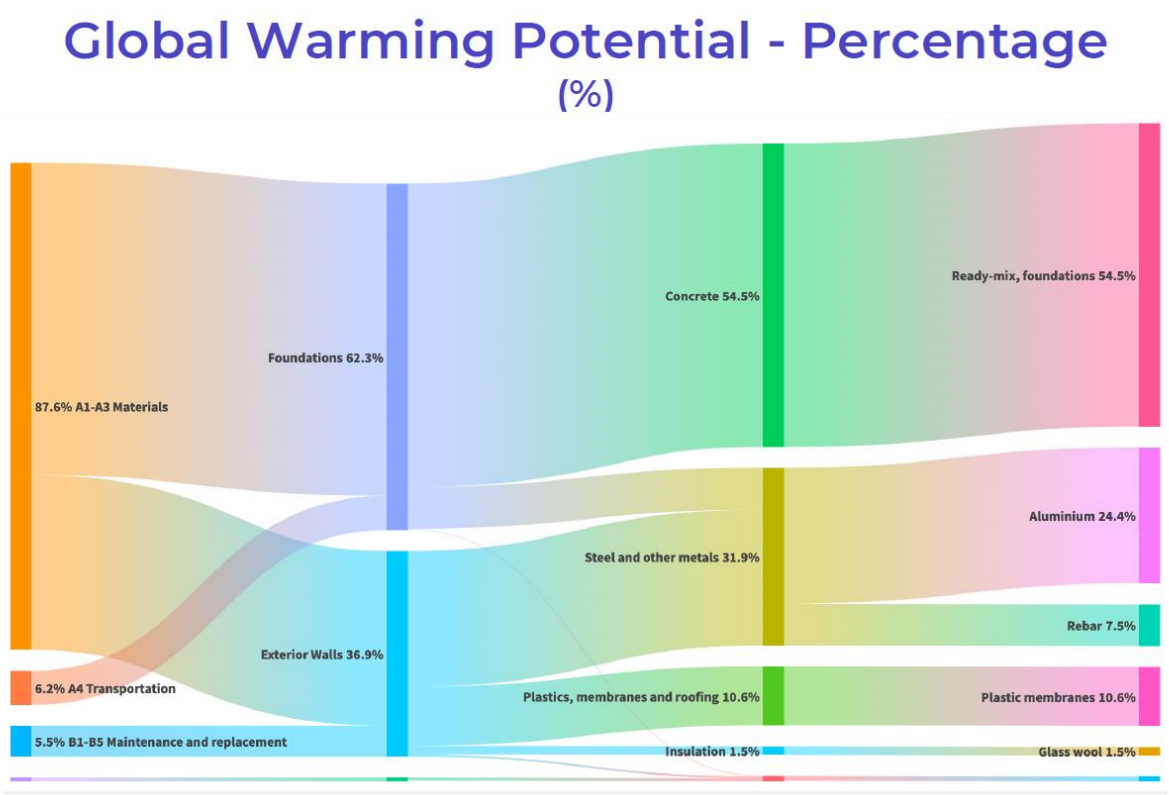
Is this floating farm the future of our food?

Barcelona-based design firm Forward Thinking Architecture has proposed a 2.2 million square foot, solar-powered offshore floating farm, Smithsonian.com reports. The barge would be 656 x 1,050 feet, multi-leveled and rectangular. The bottom level would include fish farms, a slaughterhouse, a packaging area,.....

http://www.newsweek.com/vertical-farms-across-world-385696#.Vi96WMSxjv4.mailto

http://www.inverse.stfi.re/article/6808-the-future-of-montreal-an-urban-gardening-haven?sf=bvgneb&utm_content=bufferc120a&utm_medium=social&utm_source=twitter.com&utm_campaign=buffer

The materials used such as ETFE or PVC membranes and aluminum beams score very well, especially as other materials such as concrete and steel are compared as we can see below from this third party independent assessment.



In the queue at the store, the cashier told the older woman that she should bring her own grocery bag because plastic bags weren't good for the environment. The woman apologized to him and explained, "The stores didn't use plastic bags back in my day." The clerk responded, "That's our problem today. The former generation didn't care enough to do the green thing and save our environment." He was right, that generation **didn't have the green thing in its day.**

Back then, they returned their milk bottles, soda bottles and beer bottles to the store. The store sent them back to the plant to be washed and sterilized and refilled, so it could use the same bottles over and over. So they were recycled.

In her day, they walked up stairs, because they didn't have an escalator in every store and office building. They walked to the grocery store and didn't climb into a 300-horsepower machine every time they had to go two blocks. But the young cashier was right…**they didn't have the green thing back then.**

Back then, they washed the baby's diapers because they didn't have the throw-away kind. They dried clothes on a line, not in an energy gobbling machine burning up 220 volts - wind and solar power really did dry the clothes. Kids got hand-me-down clothes from their brothers or sisters, not always brand-new clothing. But the young cashier was right…**they didn't have the green thing back then**.

Back then, they had one TV, or radio, in the house - not a TV in every room. And the TV had a small screen the size of a handkerchief, not a screen the size of the wall. In the kitchen, they blended and stirred by hand because they didn't have electric machines to do everything for you. When they packaged a fragile item to send in the mail, they used a wadded up old newspaper to cushion it, not styrofoam or plastic bubble wrap. Back then, they didn't fire up an engine and burn gas just to cut the lawn. They used a push mower that ran on human power. They exercised by working so they didn't need to go to a health club to run on treadmills that operate on electricity. But the young cashier was right…**they didn't have the green thing back then**.

They drank from a fountain when they were thirsty instead of using a cup or a plastic bottle every time they had a drink of water. They refilled their writing pens with ink instead of buying a new pen, and they replaced the razor blades in a razor instead of throwing away the whole razor just because the blade got dull. But the young cashier was right…**they didn't have the green thing back then.**

Back then, people took the tram or a bus and kids rode their bikes to school or went on the bus instead of turning their moms into a 24-hour taxi service. They had one electrical outlet in a room, not an entire bank of sockets to power a dozen appliances.

And they didn't need a computerized gadget to receive a signal beamed from satellites 2,000 miles out in space in order to find the nearest pizza joint. But isn't it sad the current generation laments how wasteful the old folks were just because **they didn't have the green thing back then?**

It's interesting to contrast where we have come from and where "that which we rather not speak about" likely has us going. The 'green thing' speaks very much to that trend and it has only just scratched the surface of the depths to which it is heading. The smart money knows it very well, and as usual, they have quietly paddled well out into the lead… quite often, as usual not with the greater good in mind! Sorry to have to say it! You'll need to think for yourself!