# Addressing the Cost of Efficiency

**By Rob Bernhardt, May 2021**

# Does Better Mean Less Affordable?

The question of cost comes up when discussing any form of change, whether it be automobiles, cell phones or better buildings. Throughout history, humans have bettered their life through innovation, delivering better products for less money, yet a pervasive assumption persists in the construction sector that improvements to building efficiency, durability, resilience or health will negatively impact affordability. The opposite is in fact true, yet the assumption continues in many circles.

To address this assumption, I have frequently been asked for costing studies to demonstrate the affordability of highly energy efficient new buildings. The "better costs more" narrative assumes, for example, that energy efficiency requires adding stuff to buildings, thereby increasing cost, rather than designing them differently to achieve better outcomes. This article is written to provide a response to those concerned about the cost of climate and people friendly new buildings.

The cost issue can be viewed from two valid, but distinct, perspectives – that of a ***policy maker*** and that of an ***owner or developer***.

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# The Policy Makers' Perspective

From a policy makers perspective, the potential cost implications do not alter what needs to be achieved. Climate science informs us that effective mitigation requires buildings delivering the 4 fundamentals:

1. maximized operating efficiency;
2. minimized embodied carbon;
3. reliance on renewable energy; and
4. minimized lock in effects by delivering all of the above as soon as possible.

The international Passive House standard is the most stringent energy efficiency standard currently deployed successfully at scale. For that reason the Passive House level of operating efficiency is a foundation to be improved upon over time[1] and has long been recognized as an appropriate level of efficiency for buildings codes, even before climate change became the priority[2]. The IEA/OECD paper Energy Efficiency Requirements in Building Codes found in 2008 that level of performance both affordable and appropriate, yet perceptions of cost persist, demonstrating how resistant to change entrenched beliefs can be, particularly when individuals prefer the status quo.

In assessing a proposed action, it's cost must first be compared to the cost of inaction. Data on the costs of climate change, lack of resilience, unhealthy buildings, etc. is mounting, and alarming. The next question from a public interest perspective is "Who pays for what?" If a developer is not responsible for delivering better buildings, someone, perhaps everyone, must pay for the high emissions, the high energy use or an expensive retrofit; there is no escaping the growing impact of climate change.

> *"There is no escaping the growing impact of climate change."*

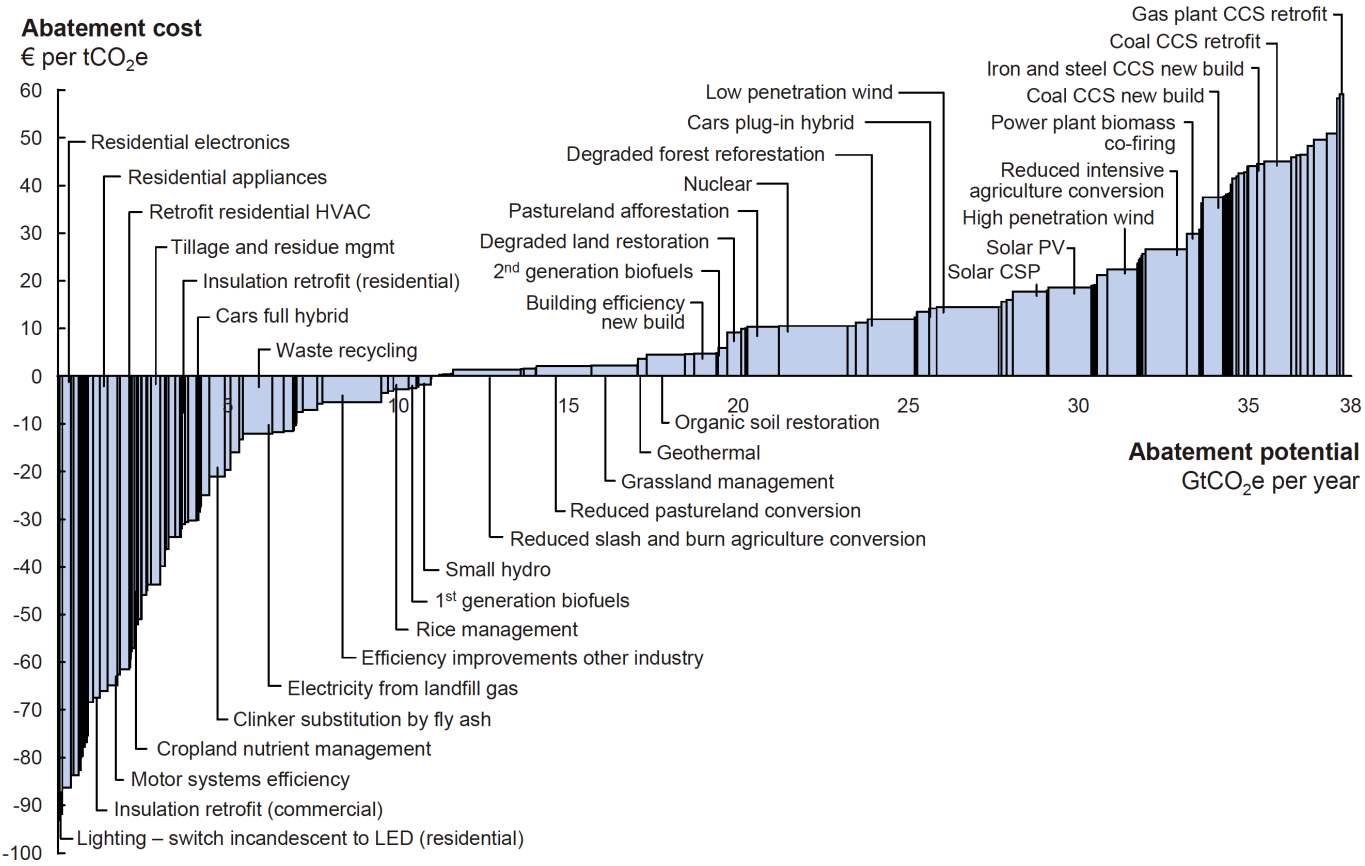
All too frequently, the cost argument put forward as an excuse for fuel switching without maximizing operating efficiency. To understand why fuel switching does not replace efficiency, one only needs to consider the sources of our energy. With the vast majority of our energy supply coming from fossil fuels (81% globally[3] and 74% in Canada[4]) there is no viable path to a renewable energy future without maximizing energy efficiency in all sectors. For this reason, energy efficiency represents more than 40% of the emissions abatement needed by 2040, according to the IEA Sustainable Development Scenario[5].

These realities have been known since the early days of mitigation planning and are reflected in the 'abatement cost curve'.

Figure 1 below is a frequently cited example prepared by McKinsey & Company[6] in 2009, demonstrating the longstanding recognition of these principles. While the cost and abatement potential of each abatement measure changes with time and technology, the reality the graph outlines does not alter. Many abatement measures generate a positive financial return for society while others are expensive, and efficiency is more cost effective than generating additional energy.

## Figure 1

### Global GHG abatement cost curve beyond business-as-usual – 2030

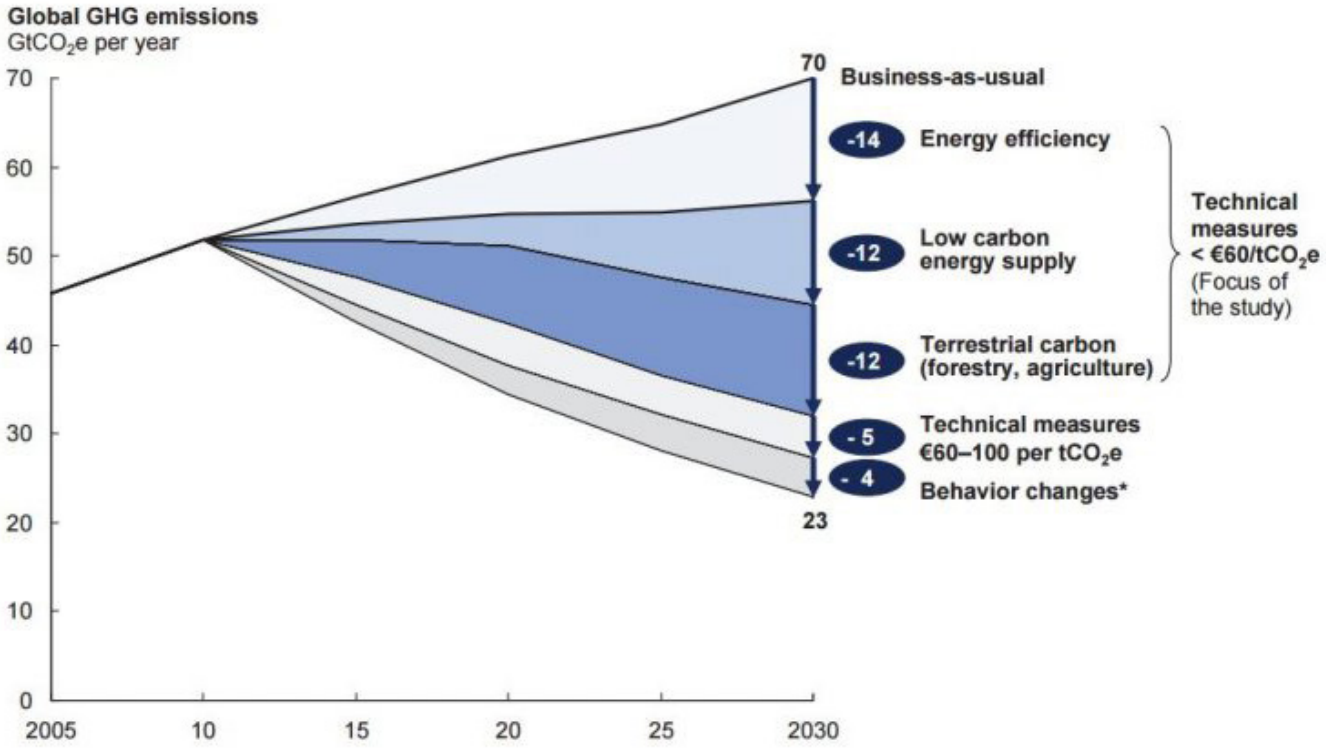



Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €60 per $tCO_2e$ if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.
Source: Global GHG Abatement Cost Curve v2.0

Global emissions reductions opportunities are illustrated in Figure 2 below taken from the same McKinsey & Company report showing energy efficiency offering the opportunity to reduce emissions by 14 GtCO2e compared to 12 Gt from switching to renewable energy. Effective mitigation requires both efficiency and a renewable energy supply.

**Figure 2**

## Major categories of abatement opportunities




* The estimate of behavioral change abatement potential was made after implementation of all technical levers; the potential would be higher if modeled before implementation of the technical levers.

Source: Global GHG Abatement Cost Curve v2.0; Houghton; IEA; US EPA

While emissions can be a valid metric at a city scale, efficiency is the operating metric at the building scale, recognizing that the energy supply also needs to be carbon free. Whatever challenges we see in maximizing building efficiency, they remain among the easiest and cheapest sectors to improve[7], and one of the few sectors in which society generates a positive financial return from doing so[8].

If such climate and people friendly buildings are felt to be too costly, society's obligation is to identify cost effective ways of delivering them – the laws of physics driving climate science do not change to accommodate the outcomes we are currently comfortable with. We need to find ways to deliver what science tells us is required. From that perspective, theoretical costing studies of what it might cost based on current designs, components, knowledge and skills are irrelevant. Effective policy discussions are about how to achieve better outcomes rather than reducing targets.

Another point to keep in mind is that construction costs and market price are not the same. Typically, speculative developers sell or rent their units for as much as the market will bear – hopefully an amount exceeding their cost, but not always. The price to consumers is independent of the cost to the developer. Furthermore, the price developers pay for land is determined by a calculation starting with the market value of the proposed units, less development and construction costs plus a profit. If all other factors remain constant, land costs will moderate as construction costs go up. Developers do not knowingly bid the land price up beyond the limits of profitability. In most of Canada land costs have continued to escalate due to market conditions and construction costs have skyrocketed due to materials costs and other factors. The impact on affordability of escalating costs for land and materials are massive compared to the cost of energy efficiency. Our affordability challenge exists with or without better buildings and will not be resolved by delivering shoddy buildings.

> *"Construction costs and market price are not the same."*

The policy makers perspective is therefore straightforward – climate science dictates what is required and we are not given a choice from a menu of less ambitious outcomes. With that reality in mind, policy makers are in a better position to address concerns of cost raised by reluctant industry members. Links to costing studies and cost effective project examples are set out below, but from a policy makers perspective, all that matters is that industry is currently delivering climate friendly projects cost effectively, and there are data and projects demonstrating this fact across Canada and internationally.

If you are met with claims that performance diminishes rather than improves affordability, ask for data to support that assertion. Remember the sign Michael Bloomberg is reported to have kept on this desk while Mayor of New York: "In God we trust. All others, bring data." You can be confident no credible data exists. If you are provided with cost estimates indicating greatly increased costs, have a practitioner with experience in such projects review the estimate – reasons for the high costs are usually not difficult to spot.


If the assertion is made by an industry association, know that members of that association are probably among the industry leaders able and willing to contradict the high cost narrative. Some industry associations are forward thinking, recognizing the economic opportunities better buildings offer and can help advance buildings. Others are more reactive, with leadership reflecting the views of their average member, entrenching the status quo.

# The Owners' or Developers' Perspective

From an individuals' perspective the issue is more complex. There are a number of cost drivers they have little influence over and may be fixed for a specific project. For example, the cost of the land, components, and locally available workforce with the required experience are all factors a specific project will face. Despite such realities, leading owners and builders are finding ways to maximize efficiency without materially increasing costs. How?

First, market leaders recognize affordably maximizing energy efficiency requires different solutions. If someone simply calculates the cost of additional insulation, better windows, better ventilation, etc. for a pre-existing design, the incremental cost is certain to be significant. The secret to cost optimization is innovation in design and project delivery. Setting ambitious performance benchmarks such as the international Passive House standard drives innovation in design to meet performance benchmarks, changing the cost parameters. For example, the drive to simplify the building form to minimize thermal bridging or the area to volume ratio, also reduces costs. Maximization of natural ventilation through building design to reduce ventilation or cooling energy loads may also reduce the investment in mechanical equipment. Windows that minimize mullions are not only more energy efficient, they are less costly.

These factors add up, offsetting costs inexperienced teams anticipate when contemplating a highly energy efficient building.

In small buildings, the form factor is particularly important, with strict energy targets motivating large reductions in envelope area for a given floor area. For these reasons we see Passive House homes being constructed in the same price range as other homes on the same block. A more detailed explanation of the importance of the form factor in single family homes is contained in an article I authored titled The Reference Building Approach, the 5th article in the Policy Series published by Passive House Canada.

> *Most teams experience reduced costs with each project.*

During the March 26th, 2021 Decarb Lunch hosted by ZEBx in Vancouver, an experienced construction manager spoke about the construction of a 6 story mixed use wood frame Passive House in Vancouver. That construction company was also building a few similar code minimum MURBs in the same market. His observation was that the Passive House was no more expensive to build because the experienced design team had met the performance requirements through a simpler, more cost effective design. Ontario readers may have heard presentations from affordable housing providers in their province able to deliver projects offering initial cost parity in addition to long term operating savings.

It is common for early projects to have a cost premium as teams become familiar with new design choices and other methods of saving costs. Most teams experience reduced costs with each project, some delivering Passive House projects at cost parity, or even less initial cost. It is reasonable to assume a small incremental cost for a highly efficient building. However, if the proposed design does not improve affordability over a typical code minimum design, the design should be re-worked to ensure the building is more affordable. When I developed Passive House projects in the early years, we were able to ensure the incremental cost, when added to a mortgage, made the owner immediately cash positive because operating costs declined more than the mortgage payments increased.

A comprehensive review of the cost of highly efficient buildings can be found in Advances Toward a Net-Zero Global Building Sector, a paper I co-authored. A review of costing studies beginning at p. 239 cites studies from around the world plus data on completed projects. Leading deep energy retrofit programs are successfully reducing costs while delivering the required performance. The largest North American dataset for new construction of affordable housing is from the Pennsylvania Housing Finance Authority tracking 268 projects, 74 of which were Passive House projects. In the first year of their program, when few Passive House projects existed in the state, Passive House projects cost an average of 5.8% more than code minimum projects. In the second year, that premium dropped to 1.6% and by the third year Passive House projects were, on average, 3.3% **cheaper** than conventional buildings. Over those three years the average cost of a Passive House project was 1.7% less than other projects.

The findings of that paper in relation to project costs are summarized on p. 241 as follows:

> "Concerns about the incremental cost of energy efficiency are frequently raised, but data from many jurisdictions illustrate that highly efficient low-carbon buildings can be the most affordable option when competently designed and built. There may be a small increase in design and construction costs, but operational savings more than compensate. Innovation in design, construction, project delivery, and components drive costs down to a greater extent than theoretical costing studies predict. Programs such as Energiesprong and the NYSERDA net-zero affordable housing program demonstrate the scale of cost savings available through innovation, including policy innovation, offering society vastly improved building stock at a lower cost."

Innovation in project delivery is mentioned in the quote above and supplements innovative design, representing an untapped source of savings in the construction sector. Conventional procurement, design and construction includes inefficient practices and entails significant risk, waste, change orders, project delays and budget overruns. Industry recognizes this reality and is initiating practices to deliver projects more cost effectively. Be sure your company is keeping abreast of opportunities to improve project delivery.

If you as an owner or builder have difficulty conceiving how these results are achieved, the solution is to become familiar with the delivery of such projects. Get trained in their design and construction, attend seminars and project tours. Learn how your competitors are delivering a superior, more affordable product without materially increasing costs. If they can do it, so can you. Above all, do not risk being identified as an owner or builder not familiar with contemporary design and construction practices.

## About the Author

### Rob Bernhardt

As the former CEO of Passive House Canada, Rob worked with industry leaders, international agencies, national, provincial and local governments in developing leading projects and building policy. Prior to that he developed and sold certified Passive House buildings and lives in the first certified Passive House on Vancouver Island.

# References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