

The engine is not responding **A critique of the automatic energy-saving home**

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The new Norwegian building code of 2010 - and expectations concerning the regulation fixing them to passive standard from 2015 - means that we are about to pass a milestone in the Norwegian building traditions. For the first time "requirement" for mechanical systems is being brought in as a prerequisite for living. That the direct energy and climate effects of these measures will often be questionable, and that it also relates to serious climatic problems, have both gradually become a part of the public debate. This article attempts to penetrate deeper into some of the social, political and cultural aspects of this that must now be called a fateful paradigm shift.

“The first time I flew in an intercontinental Airbus, I was told the story of the technological principles behind them. It is possible that it is partly a myth, but it said that this plane is so optimized and highly tuned with the speed and fuel consumption, that it can no longer be controlled by humans, but is dependent on a wide range of computers to keep the height and balance. The pilots are there primarily to ensure contact with the airports around the globe, and perhaps also for appearance's sake. Manual override is impossible and if the electronics fail the plan will immediately hit the ground.”

With the changes now being implemented in the building sector in Norway and most EU countries, the same procedure will also soon apply to our houses. Indoor air quality and energy management will increasingly be at the mercy of finely tuned machinery, that is beyond our influence. Control systems for temperature and lighting, fully automatic boilers and blinds, heat pumps, heat exchangers and balanced ventilation system will take over the job we have previously done for ourselves by opening and closing windows, firing the woodstove, dressing in sweaters, turning on and off lights, drawing curtains, etc. . And the assertion that they can apparently also do the job better than us has legitimized an aggressive marketing and subsidy policy, with the stated goal of as many people as possible taking up this new technology.

Together with last summer's changes to the (Norwegian) Planning and Building Act was also the first injunction. Everything that is built and refurbished in the future will be required to be provided with a balanced ventilation system with heat recovery. Although not expressed directly, this is the consequence when the energy section and ventilation portion of the regulations are seen in context. In 2015 there will be an introduction of the passive house standard, and from 2020 probably a pure zero-energy standard; in both cases, these measures will intensify the use of technology even further. In parallel with this development is now the so-called ‘smart’ house, which in addition to the arsenal of energy-saving measures will also include a range of additional benefits, such as safety mechanisms for the elderly and disabled:-

Are the doors going to be closed and locked? Are the cooking plates off? And taken to its next level: is the heart rhythm good? should medication be taken, etc. It's all action with the best of intentions, and thus, in the same way as the energy measures, very suitable for inclusion in future building regulations, under the paragraph "Universal design ", "Fire" etc.

Although this development is taking place in all building types, I will in the following concentrate on housing. It is this that forms the basis for our lives, and this is where we are most vulnerable. The question then becomes, despite all good intentions, if we are on the right track. How do the measures now being implemented, and largely required, square with our concept of good housing and the possibility of a free and meaningful life? Will this be causing a standardization of temperature, moisture and odors that are a condition for technology choice, from our expression and experience opportunities? And will we all be able to meet the requirements of discipline and amenability that technology makes for us?

Finally I will discuss the chances of achieving the objectives. Is a focus on energy the way to go to overcome the climate crisis? I do not believe it, at least not without a major clean-up of the assumptions that are currently applied.

Growth economics and technology choices

In the EU's energy directive from 2008, which forms the basis for both new Norwegian building regulations as the plans for a general passive-standard, attaches great importance to the potential for growth in jobs, this talking of between 280 000 and 450 000 new jobs in construction - in connection with energy certification and audit - and inspection of heating and ventilation systems. In addition, there are new jobs created in the industry for the production of energy-saving components and materials. Expectations also mobilize the stock markets. In the movie, "*Money never sleeps*", which may be used as an indicator, the arch-capitalist Gordon Gekko states that "*green is the new bubble.*"

The Economics of our system will apparently not work without growth. In economic theory, there exists the term "creative destruction". It describes innovation as the real driving force behind sustainable economic growth, in seeing the new continuous clear out the old. We recognize this pattern in the computer world. First, came the basic product. Next comes the portable version, and eventually wireless technology. And finally a new version of the original product. In addition to being marketable for a price that offers great product earnings it needs also to be complex enough to be commercialized. People should not be able to make them themselves, and preferably also not be able to maintain them. This ensures consumption and thus the flow of capital through society.

Growth and earnings in the private sector also run the state. And if the products also can be said to be for a good cause, it gradually becomes almost routine for the authorities in European countries to submit the feeder stimulus. More often it is also claimed that certain products should be used. The sand in the kindergarten sand boxes can no longer be collected by volunteers from the nearest beach or sand pits, it is a specialized product that must be purchased from a central supplier. It is not acceptable to cover cow-stalls with straw, it requires high pressure foam mattresses. And equally

in building policy it is not the aim to open up to simple approaches. It is thus quite logical that natural ventilation is rejected in favor of more complex and highly mechanized ventilation strategies.

In line with the dogma of 'creative destruction' the passive house will also eventually have to be killed off. We have already had the zero model house, which in turn will be superseded by the so-called plus house. And so rigid and specialized as these building types are now about to be, there will be little opportunity for reconstruction and adaptation. There will therefore be a lot of demolition.

In many ways, the state stands with its back against the wall. Economic growth in the economy appears to be a necessary prerequisite for further financing of social security and road construction. It can thus instantly be linked to suspicions about improper and vicarious reasons to government regulations and new standards, thereby, in addition to pretending to solve a problem, it will also provide some government finance. One might almost be tempted to speculate as to whether the climate crisis is a hoax, staged in order to ensure economic growth. It appears in fact to be a very good idea arriving at just the right time: Climate technology represents a whole range of new products, that we are only a few years ago had no clue that we needed.

In Report No. 7 (2008-2009) the government determines that Norway has to "contribute to the development of technology that helps to show that it is possible to decouple economic growth from growth in greenhouse gas emissions." According to a number of economists and ecologists, this is an incorrect link, and an impossibility that can best be compared with the performance of a perpetual motion machine¹. By its nature, the economy is an open subsystem subordinate to the earth's ecosystem, which in turn is finite, without the possibility to grow and is a materially closed loop. As long as the economic subsystem grows it will incorporate more and more of the total ecosystem, until the limit of 100% is reached.

And what about residents?

The results of technological development have always been presented as social and cultural progress. New inventions in medicine, transportation, communication, education, economy, housing, etc. - are all considered as a kind of inevitable evolution and enhancement of culture. But often we have not seen the scope of procurement. That other aspects of human life have been altered, reconstructed and transformed is less clear. High-tech medicine has brought with it new diseases, computer networks invade privacy and overwhelm us with information, and new production technologies have increased stress in the workplace rather than to diminish it.

Also in the building sector, we have seen the consequences. For example, a wide range of building materials introduced over the past fifty years, have been shown to emit harmful gases into the indoor environment. And the links can be even more subtle than that, the British architectural critic Martin Pawleys considers 'central heating' to be a driving force behind the breakdown of family solidarity in the

¹ A.o. Daly HE et al *Valuing the earth: Economics, Ecology, Ethics* MIT Press 1993; Beddoe R et al *Overcoming systemic roadblocks to sustainability* PNAS 2009

Western world, by family members residing in different rooms throughout the winter rather than gathering together around the fireplace.

Technologists seek ways to keep the focus on the object and what is new and groundbreaking about it, whilst ignoring the restriction to the social environment into which the object is to be introduced. In a Swedish study of residents in low-energy homes there was a highly positive (even proud) reaction by owners to the automatic temperature controls the houses were equipped with. But when this was reviewed more closely, it turned out that almost none had adopted it, nor knew how it should be connected and operated. And some of them showed an almost active lack of interest in its possibilities². The example describes a fundamental ambivalence that includes much of the technology we are introduced to: on the one hand an almost unfettered acceptance, on the other hand, fundamental shortcomings.

*"We do not know where we are going, But we are on our way",
Langdon Winner*

Winner is a firm believer that - with this mantra - we have now exceeded the limit where we are able to challenge or criticize technological developments³.

The question will always be whether people have the technology, the socio-technical world that they really want and whether it is for the good of the planet. This is a complex question, because you rarely know what you really want until you have experienced what you have. And then it can often be too late, as the technology development through standardization and interception of alternative development directions is made irreversible.

The house as an incubator or self-expression?

Le Corbusier dreamed already in the interwar years to build anywhere on the globe with *"une respiration exacte."* And so it was, our houses, and most of the other indoor spaces in which we spend our lives, become more or less fully air-conditioned, with overall control given to management systems. A necessary foundation for this automation has been to establish the exact comfort level that everything is to be controlled for.

The EU standard for comfort is based on the so-called PMV scale, developed by the Dane Ole Fanger. It includes air and radiant temperature, air velocity and relative humidity, with 0 on the scale representing *"I feel neither cold nor hot."* The reference condition of comfort thus defined as a perceptual absence. The same method is applied for the norms of smell, where the 'absence of smell' should be sought.

The result is that the buildings must be well ventilated, in part to extremely good. And to get this to hang together with the ambitious level of energy efficiency which is now required in passive houses, it has been necessary to add heat exchangers on the exhaust air together with their the necessary controls. There are several ways to arrange this. A widely used method means that the air quantity is regulated by CO₂

² Henning A *Can qualitative methods support the development of more flexible and energy saving thermal comfort* SERC 2007

³ Winner L *The Whale and the Reactor* University of Chicago Press 1986

sensors in every room, where the CO2 concentration is expected to indicate the user load. This thus remains a pure automation technology based on the PMV scale, and must not be confused with user control. The resident's own sense of adventure will continue to be overridden, and therefore we arrive very close to a passive incubator state.

Paradoxically, one of the pioneer founders of modern architecture, Richard Neutra, defends the idea of an "omnisensorial experience" - that we need a wide range of sensory challenges, not just to protect our own humanity, but also to experience architecture. And anthropologist Edward Hall adds that we are approaching an antiseptic architecture "*where all sensations other than visualizing tend to disappear*"⁴. He believes that this not only deprives us of opportunities to experience and develop as individuals, but also affect memory, given the fact that smells, to a greater extent than images, are capable of arousing deep memories in us. One may also wonder what are the conditions in which pheromones in a bedroom require to be ventilated by the building regulation requirements to a level of 26 m³ fresh air per hour per bed space ...

In fact, studies have indicated that it can be downright healthy to have fluctuations in thermal conditions. And that the threshold for "0" on the PMV scale will be dependent on sex, menstrual cycle, race, obesity, season and time of day. Also, age plays a part - children naturally like to have conditions that are cooler than adults, but they can quickly become socialized to warmer environments. The consequence may be that our children will choose a higher temperature faster, which will inevitably lead to a higher energy consumption in society. The use of automated climate itself can provide similar results, as it turns out that the tolerance for a lower room temperature as well as fluctuations in temperature is much lower among residents of automated buildings^{5,6}. The reasons for this are uncertain, but it is believed to be linked to the fact that in more naturally ventilated buildings people have greater influence over their own situation.

Every area of technical / functional organization of modern society can be regarded as a type of instrumentalisation that we are doomed to submit to. Technology stands, in many cases, between ourselves and nature. Perhaps also between ourselves and our own nature. And it regulates our relationships instead of us regulating them.

*"Early this morning, I was in a bad mood and decided to break a law and start my car 'without buckling my seat belt' confesses sociologist Bruno Latour⁷.
"It first flashes a red light FASTEN YOUR SEAT BELT!", And then an alarm sounds: it is so highly pitched, so relentless, so repetitive, that I cannot stand it. After 10 seconds I usually swear and put on the belt. This time, I stood the alarm for twenty seconds and then gave in. My mood had worsened quite a bit, but I was at peace with the law – at least with That law. I wanted to break it, but could not. Where is the morality? In me, a human driver, dominated by the mindless power of an artifact? Or in the artifact, forcing me, a mindless human, to obey [...]?"*

⁴ Hall E *The Fourth Dimension In Architecture: The Impact of Building on Behavior* Anchor 1990

⁵ Charles KE *Fanger's Thermal Comfort and Draught Models* NRC 2003

⁶ Socialstyrelsen *Temperatur inomhus* 2005

⁷ Latour B *Where are the Missing Masses? The Sociology of a few Mundane Artifacts* MIT Press 1997

A similar regime will be an unconditional basis for automatic energy-saving in homes. To turn off the fan because it is too noisy, or to open the bedroom window at night so that the exhaust air escapes the heat exchanger, is a form of sabotage, not only against one's own energy bill, but against society as such.

Will we master it?

Most people are acquainted with the phenomenon of "techno stress", for example, when your computer crashes or mobile phone suddenly turns itself off. And the risk increases as we are increasingly surrounded and made dependent on technical solutions that we lack knowledge of. 'Smart Home' technology appears as a set of impenetrable black boxes, with input that provides output, and thus maintains and manages an ever-wider range of residents' needs at any one time. Norwegian government report NOU 2001:22 presents 'Smart House' with unrestrained euphoria, but still notes that "Confidence in the system can cause the user to change behavior and stop them controlling risk factors themselves (such as the hotplate being turned off)".

Many would argue that humans have a fundamental need to take care of themselves, to master their own life conditions. As recently as 4-5 years ago, one could still hear the apology: "Why can I no longer replace the light bulb in my car"? Today, this appeal is outdated. A technology needs only a few years to establish itself as an acceptance that this is how it should be. In many cases this means that our room for maneuver is reduced, and thus influence and domination over our lives. The psychologist Richard Stivers believes that technology in this way colonizes our experiences, opinions, feelings and consciousness. And it thus in the long term break down our discernment and responsibility⁸.

After the demand for wood stove and chimney was abolished in the Norwegian Technical Regulations 2010, there is nothing as uninhabitable and dysfunctional as a passive house, when the electric power goes out, which is expected to occur more frequently in the future as a result of climate change⁹. The engine is not responding; all of the ventilation and heating systems grind to a halt, and any form of human intervention is ineffective.

1. EPILOG: Towards a more effective energy efficiency?

I have in this article tried to describe how many of the rapid and often irreversible choices now being made to increase energy efficiency and reduce greenhouse loads within the building sector has problematic aspects. The impact will partly be due to fundamental changes of the housing function. And several of the measures will have socio-cultural consequences that in turn could easily undermine the effectiveness of them.

And behind the choices are consistent assumptions of a simultaneous contribution to

⁸ Stivers R *The Technological Personality* Bulletin of Science Technology & Society 2004 24

⁹ Nasjonal sårbarhets- og beredskapsrapport DSB 2008.

economic growth. This has largely spread into the research programs, which has gone from being a science in the public interest to be science for private benefit¹⁰.

The question is whether or not climate change is too serious to have this growth requirement imposed upon it. That situation is now so critical and the threat so great that one must seek the best solutions, irrespective of commercial considerations. And that the process is based on the recognition that the parallel exploration of several solution options can not only provide a more robust response, but also maintain the retreat from a blind alley as this will certainly manifest itself.

While the passive house strategy focuses on the highest possible performance at the moment of completion, it may well be that the gain over time will be larger by reducing the focus on this, and perhaps even reduce the technical energy efficiency somewhat in favor of more democratic and personalized solutions.

EPILOG: But where did the saved energy go?

Let us assume that we have - through a more holistic approach - managed to develop technological requirements for a secure and sustainable energy efficiency of our buildings. Is it so given that this will lead to reductions in overall energy consumption and thus greenhouse gas CO₂?

The basic problem is that energy represents the one item that is always needed to create or use something. And again, there is the demand for a growing economy lurking behind this. The economist Robert Ayres argues that energy efficiency can already explain 60% of economic growth in the U.S. over the past 100 years, while increased input of capital and labor only explains 40%¹¹. If this is correct, and also applies to the future, we can assume that energy efficiency leads to strong economic growth. And the result we know well, increased consumption of raw materials and emissions of pollutants, and enhanced stress on natural areas and biological diversity. Ayres concludes that this growth stimulation will be so powerful that the results can quickly become a net increase in energy consumption.

The pattern can be easily tracked in the building sector. While the building regulations from 1960 to 1990 on several occasions got tougher insulation requirements, and technological developments simultaneously launched more energy efficient materials, heating and ventilation systems, energy consumption rose in the housing stock in the same period by almost 40%. The background was a simultaneous rise in floor space. But for apartment buildings there was also an increase in energy consumption per square meter, as we have expanded the heating season and turned up the room temperature, and larger parts of the area warms up, partly because the storage areas in the basement and attic are now almost completely integrated into the heated areas of the house.

The phenomenon is described as “the rebound effect” and the background is this:

¹⁰ Cooper MH *Commercialization of the University and Problem Choice by Academic Biological Scientists* Science Technology Human Values 2009:34.

¹¹ Ayres R et al *The Economic Growth Engine* EE 2009

When the energy use is reduced, the households release a greater proportion of their salary for other purposes. Several consumer researchers have already noted that in addition to building bigger houses people are also renovating and replacing furnishings more often¹². In addition, the desire to travel rises and we buy more electronics, clothing and other consumer goods, which in most cases are produced with low efficiency coal burning in Asia. The result of energy efficiency in the building sector can thus, in the worst case, be that the total greenhouse gas emissions rise, so-called "back fire".

We have basically three ways to control energy consumption: consuming more efficiently, consuming differently or consuming less. We currently have concentrated on the first opportunity, to consume more efficiently. This does not seem to work. Energy-efficiency without a simultaneously overall reduction in climate gas emissions seems pointless. To consume *differently* means that the money used for less stressful climate items like stamp collecting, the hairdresser and cultural experiences generally, not to mention the architectural quality over quantity. Here, the possibilities are many. And finally, we have the option to *spend less*, which for the building sector will primarily mean reduced floor space.

Many would argue that the answer lies in a combination of these three methods of action. And customized tools for global distribution of the burdens of such an approach have already been developed, including the so-called "personal carbon quotas"¹³. And this will not necessarily be in conflict with the welfare of our community, "says economist Tim Jackson in his book *Prosperity Without Growth*. While U.S. consumption has doubled over the last forty years, the proportion of Americans who consider themselves happy has dropped steadily throughout the period. And according to a population survey from Statistics Norway - 31% said in 1985 that they were materially satisfied, while in 1999 this had dropped to 21%. In the same period, the floor space rose from 30 to 50 square meters per person. The same tendency is found in most of the world's richer countries. Such results can be considered as empirical evidence that a return to a lower level of consumption would not make things worse, quite the contrary. And in the case of Norway it was perhaps appropriate when former industry minister Finn Lied stated that building the nation was already completed by the mid-1970s.

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¹² A.o. Brännlund R et al *Increased Energy Efficiency and the rebound effect* Umeå Economic Studies 642 2005.

¹³ A.o. Randers J et al *Fremtidsbilder 2030* BI 2007