Plan B for key actions to rapidly reduce greenhouse gases and to strengthen resilience of the built environment[1]

Key industry and government leaders have hesitated too long to implement adequate long-term mitigation measures. Measures that have been implemented tend to be of the no-regrets and painless variety, but these are not sufficient to make the major and rapid reductions that are needed. In view of these factors, we believe that a Plan B for more rapid action is needed, and this short paper presents a number of proposals along these lines.[2]

Considering the long lag times in the climate system, a "business as usual" approach means that GHG reductions will probably *not* come rapidly enough to avoid severe climate change impacts and we therefore face a high probability that global temperature increases will be considerably more than the target 2ºC adopted in the 2015 Paris Agreement. This will lead to massive long-term disruption of agriculture, industry, living and working conditions, as outlined by IPCC AR5 and others.

Specific direct effects will vary by region, with northern regions seeing the most change, such as hotter summer days and warmer nights and greater use of mechanical cooling systems, an increased probability of windstorms in some regions, highly variable precipitation ranging from droughts to periods of intense rainfall, and storm surges along sea coasts. Secondary impacts are likely to include higher death rates during heat waves, aggravated water shortages due to increased evaporation, migration of harmful insects northwards, and more forest fires. The combination of these problems will result in high levels of mortality and injury as well as property damage in vulnerable areas and some disruption of essential services. These factors may in turn result in a problem of climate refugees and a need for large-scale and rapid re-housing.[3]

Although a disturbing prospect, the only possibility for quick and effective action to minimize such developments will probably depend on a few major weather-related events that will cause major damage and loss of life within a short period of time in Washington, Hamburg, London, Shanghai or other symbolically important cities. In such a case, attention will become focused on climate change in a way that logic and science can never do.

Based on the history of catastrophic events, we can assume that the shock effect will open the minds of the public and decision-makers to radical measures, but only until a new catastrophe occurs. When faced with a real crisis, desperate leaders will grab whatever plans are available on the shelf, and the result is likely to be hasty, ad-hoc and poorly considered actions.

In addition, certain characteristics of the building sector make rapid and concerted action unlikely, including differentiated and diffuse building types and ownership, different levels of technical and economic capabilities in various regions and major cultural differences.

Based on these factors, we can expect relatively sudden and extreme weather events to produce the following types of effects:

- In almost all cases we can expect a surge in demand for labor and materials to carry out urgent repairs, re-building and re-location needs. Manufacturers of building materials will be faced with urgent production requests but will face increased power costs and disrupted labor and plant conditions; and supply chains may be disrupted by transportation problems.
- These factors will, within weeks, deplete the supply of skilled workers and firms in the region and cause prices for materials and services to reach very high levels.
- Owners or managers of existing commercial buildings will have to reduce operating hours to meet GHG reduction targets, and residential occupants will face mandatory energy cuts.

---

[1] *This paper was developed by Nils Larsson of iiSBE with substantial input from Teresa Coady, Jean Cinq-Mars, John Crace, Gary Martin and Mark Gorgolewski (Canada), Teresa Parejo-Navajas (Spain), Randa Mahmoud (Egypt), Daniel Charles (France), Richard Lorch, Fionn Stevenson and Tom Woolley (UK), Ann Edminster (USA), Norman Goijberg (Chile) and Wynn Cam (Singapore).*

[2] For more information contact <info@iisbe.org>

[3] See appendix 1 for a graphic representation of climate change effects and impacts.

- Standards for good design and operations, such as adequate lighting levels, indoor comfort conditions, and work to preserve heritage buildings will fall by the wayside, at least temporarily.
- Social tensions will rise to very high levels when those who want to pursue their normal activities, such commercial development, are faced with permit refusals, if priority is given to those displaced by climate change and to households suffering from energy poverty.
- The need to deal with repair and remedial work may lead governments to say that they will have to defer more GHG mitigation measures;

In such a situation greenhouse gas emissions that drive climate change will continue unabated. We can conclude that what is needed is a set of policies that can be implemented very quickly when political conditions permit. This means that such policies must be prepared now, and iiSBE offers a set of key ideas that may help to help formulate these, presented in (very) approximate order of priority. It should be noted that they do not include all issues that are central to sustainable construction, since the focus here is on actions needed for rapid GHG reductions and resilience of the built environment.

Given the likelihood of inaction to limit GHG emissions until extreme weather events make action imperative for even the most indifferent government, it is clear that we need a Plan B, and we suggest that the key points on the following pages should be considered as the basis of policies that would be ready for immediate implementation.

The proposed actions are generic, and specific policies will have to reflect different conditions in various regions. Note that, although points (1), (2) and (3) extend beyond the building and construction sector, they are highly relevant to these issues.

Specific actions proposed

1. **Measures to reduce carbon emissions:** Introduce policy measures to radically and rapidly cap and reduce carbon emissions linked to the built environment.[4]
2. **Clean energy:** Minimize reliance on fossil fuels for electricity generation[5], upgrade power grids to accommodate renewable input sources, accelerate the introduction of decentralized renewable power sources, and ensure that feed-in tariff policies do not distort energy markets.
3. **Peak electrical demand:** Rapidly reduce peak loads in electrical networks through the rate structure and through load ceilings, especially in manufacturing plants, retail and commercial facilities, by means of changes in industrial processes, operating hours or other relevant means.
4. **Critical infrastructure:** Ensure that facilities and services of critical importance, such as hospitals, public transportation systems, food supplies, water and sewage treatment and pumping systems, can remain functional at a basic level of performance under extreme conditions.[6]
5. **Protect key facilities:** Prepare for the protection or relocation of key facilities such as power plants, distribution networks, docks and airports and of populations of residential areas vulnerable to flooding, storm surges or fire.[7]
6. **Reduce locational risks**: Prohibit new construction in areas with a high risk of flooding or fire.
7. **Conserve land:** In developed countries, except for cases of replacement, impose a freeze on new construction and supporting infrastructure in un-serviced or low-density areas.
8. **Urban infill and mixed use:** Establish urban infill programs and promote mixed-use development to make better use of urban land and to support the viability of local public transport [8].

[4] Possible measures include carbon taxes, cap and trade or personal allowances. Such measures have the added benefit of reducing air pollution.
[5] The use of coal and heavy oils is especially problematic because of low efficiency and high emissions.
[6] This may require provision of back-up electrical power, heat, water or other vital services on a decentralized basis.
[7] Note that such projects may require 5 years or more to carry out, even on an urgent basis.
[8] High densities can be achieved with mid-rise buildings, and very tall buildings are not necessarily required.

9. **Housing relocated populations:** Launch programs to identify hotels and surplus office buildings that may be suitable for rapid conversion to residential uses and identify empty dwellings that may be useful for relocated populations.[9]
10. **Embodied energy and emissions:** Support adoption of environmental product declarations and require estimates of embodied emissions for heavy construction materials in major projects.
11. **Performance Assessments:** Ensure that performance assessments for major projects take into account possible future climate change impacts that may affect the safety, function or performance of the subject building and of its surrounding area.
12. **Monitoring and data:** Establish monitoring systems and databases within urban areas to provide annual feedback for action on energy, water and occupancy performance.
13. **Performance of existing buildings:** Improve hot weather performance, ensure a rapid reduction in operating emissions of public, commercial and multi-unit residential buildings through implementation of multi-year energy reduction retrofit plans and improved operating practices.[10]
14. **Deep green renovation**: Where substantial performance gains are possible in a large number of buildings requiring renovation, establish major programs for deep green renovation that result in nearly-zero operating emissions, better hot weather performance, reduced peak electrical loads and water consumption.
15. **Performance of new buildings:** For new construction that is permitted, limit embodied emissions, require net zero operating GHG emissions, limit peak electrical loads and water consumption.
16. **Vernacular building:** Encourage vernacular residential building design and construction techniques, where such approaches result in reduced GHG emissions and where climatic, cultural and technological conditions make this feasible.
17. **Speculative price increases:** Introduce measures to control speculation in real estate that results in large numbers of under-utilized or empty dwellings, and minimize short-term speculative increases in labor rates and costs of construction materials under extreme conditions.[11]
18. **Appliance and equipment efficiencies:** Prohibit the sale of appliances and equipment that do not meet high operating efficiency criteria (e.g. "A" label in Europe).
19. **Training:** Rapidly establish training programs for regulators, renovation contractors, simulation specialists and others who are key to the upgrading of performance in new and existing buildings.
20. **Education:** Rapidly launch public education programs to promote conservation in energy, water and materials, for investors, building operators, office tenants and residential owners or tenants.
21. **Explaining the program:** Enlist professionals and non-government organizations to help explain the need for this set of key actions to local politicians and business leaders.

Conclusions

The action agenda proposed above has been developed considering a relative lack of action in the face of the impending existential threat of climate change. Some readers may find our proposed approach to be excessively pessimistic, but it should be noted that many of the provisions listed here are logical and will produce positive results, even if we have not yet reached the state of extreme weather events that would make them inevitable and urgent.

14 December 2016

[9] Such measures may be needed if there is an influx of people from other areas displaced by climate change.

[10] Measures to improve environmental performance must recognize the need for maintaining or achieving health-promoting indoor environmental conditions.

[11] Under emergency conditions, free-market speculation can lead to material shortages and an inability to carry out urgent repair and upgrade projects.

Appendix 1: Predicted climate change impacts on the built environment

from IPCC AR4 (2007), AR5 (2014) and other sources

From IPCC AR4 and AR5		Primary and secondary impacts on urban areas and buildings	
Global effects	**Examples of major projected impacts**	**Possible direct effects on urban areas, people and buildings**	**Secondary effects**
IPCC AR5, SYR overview: In urban area climate change is projected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges (5). These risks are amplified for those lacking essential infratsructure and services or living in exposed areas.			
It is virtually certain that there will be more frequent hot and fewer cold temperature extremes over most land areas on daily and seasonal timescales (1) It is very likely that heat waves will occur with a higher frequency and longer duration. (2)	Reduction in quality of life for those people in warm areas without appropriate housing; impacts on the elderly, very young and poor.	Reduced hydro or nuclear generation because of reduced flow rates and increased water temperatures.	Intermittent or reduced and more expensive power supply.
		Summer overheating in housing and buildings with poor hot-weather performance and no space cooling, leads to illness or mortality and greater demand for retrofit and space cooling.	Emergency building retrofits to improve hot weather performance.
			More space cooling installations leads to more pressure on power supply, greater GHG emissions and smog formation.
Warmer and fewer cold days and nights over most land areas (1)	Reduced energy demand for heating; increased demand for cooling, declining air quality in cities	Growth of harmful insect populations, such as termites, mosquitos.	Damage to wooden structures from termites, health problems from insects.
		Melting permafrost in extreme North causes soil instability and release of Methane.	Repair, rebuilding, population relocation needed.
		Reduced space heating requirements in winter.	Reduced energy consumption and emissions
Warmer and more frequent hot days and nights over most land areas (1)		Increased urban heat island effect lead to higher ambient temperatures.	Negative health effects from heat stress and smog formation. Increased peak power demand from fossil-based power generation plants, with high GHG emissions.
		Reduced feasibility of night cooling	
		Increased building space cooling requirements.	
Area affected by droughts increases (3)	Water shortages … reduced hydro generation, potential for population migration.	Water shortages because of reduced supplies and drought conditions.	Prohibition of new construction in areas with insufficient renewable water resources.
		Reduced hydro or nuclear generation because of reduced flow rates and increased water temperatures.	Intermittent or reduced and more expensive power supply.
Intense tropical cyclone activity increases (3)	Disruption by flood and high winds, loss of insurance, population migration, loss of property.	Damage to infrastructure and buildings by storm events.	Temporary shelters Emergency repairs
			Higher requirements for construction quality and durability.
		Relocation of large populations after storm events	Prohibition of new construction in vulnerable areas, such as coastal areas.
Increased incidence of extreme high sea level, excluding tsunamis (3)	Costs of coastal protection v. relocation, loss of insurance, population migration, loss of property.	Relocation of large populations over the long term	Increased pressure on developable land; pressure also on land valuable for agricultural or ecological purposes.
		Temporary shelters Greenfield infrastructure, housing and other building construction	Very high capital expenditures, high GHG emissions from materials production and construction.

IPCC classification: 1 = Virtually Certain, 99% probability, 2 = Very likely (90% probability), 3 = Likely (90% probability)

N. Larsson, iiSBE, 2009 & 2016