

Introduction

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Our world is changing, bringing new challenges to the way we live. While some resources may be limited, the imagination isn't. To adapt to the stated change we will need the best of our imagination and creativity, our technology and science and our humanity and vision. This book will help to explore how we can find the spirit, imagination and knowledge to adapt to the challenges facing us.

1. From problem to promise

Having taught sustainable design at the Delft University of Technology from the early 1990s we remember a period when talking about a climate change – let alone the human influence on it – was little or no subject for scientific acclaim. The International Panel on Climate Change [IPCC 2007], the former US presidential couple of Al Gore [Gore 2006] and Bill Clinton and advisors such as Sir David King [Walker & King 2008] have supported the wide acceptance of the problem and helped to put it on the political agendas again.

Much research ever since has been aimed at the determination of the exact impact of climate change on society and the built environment. At the same time the core focus has been predominantly on effects instead of solutions that cope with these effects. Being engineers however, the latter has been our professional challenge and that of many colleagues around the world.

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Human-induced climate change and its impact on the built environment is an immediate challenge which requires a coordinated approach at international levels. Understanding the impacts of climate change on human well-being requires improved knowledge of the interactions between socio-economic factors, ecosystem conditions and built environment / buildings.

Taking climate change as a fact, the 3rd CIB international conference on Smart and Sustainable Built Environments (SASBE2009), in Delft, the Netherlands, supported contributions that put the emphasis on solutions rather than problems. Hence, climate adaptation (the adaptation in the built environment to threats by heat, storm surges, drought and water), climate mitigation (reduction of effects that aggravate the changes) yet preferably even what we call climate pro-activation, i.e. the utilisation of climate change and energy depletion as a means to improve enduring sustainability and liveability of the built environment, and in doing so helping to support the shift from problem to promise for a better world.

For this book we selected and edited peer reviewed papers from SASBE2009 following the themes that are introduced by a divers set of specials from the field of smart and sustainable building.

2. Solutions at our disposal

Is the problem to promise statement about climate and energy just an imaginary desire or can it be real? Some examples could clarify the advantage of climate change.

2.1 Climate and low-ex spatial planning

The first example relates to a low-exergetic principle of site selection. Our ideal thermal human habitat is around a temperature of 21°C. The majority of the world population lives in regions that have a lower average temperature (e.g. in Western Europe around 12 degrees Celsius). Some rise in temperature therefore hypothetically might bring our environs closer to comfort, if (with emphasis) we avoid additional warming by equipment, transport means and ourselves.

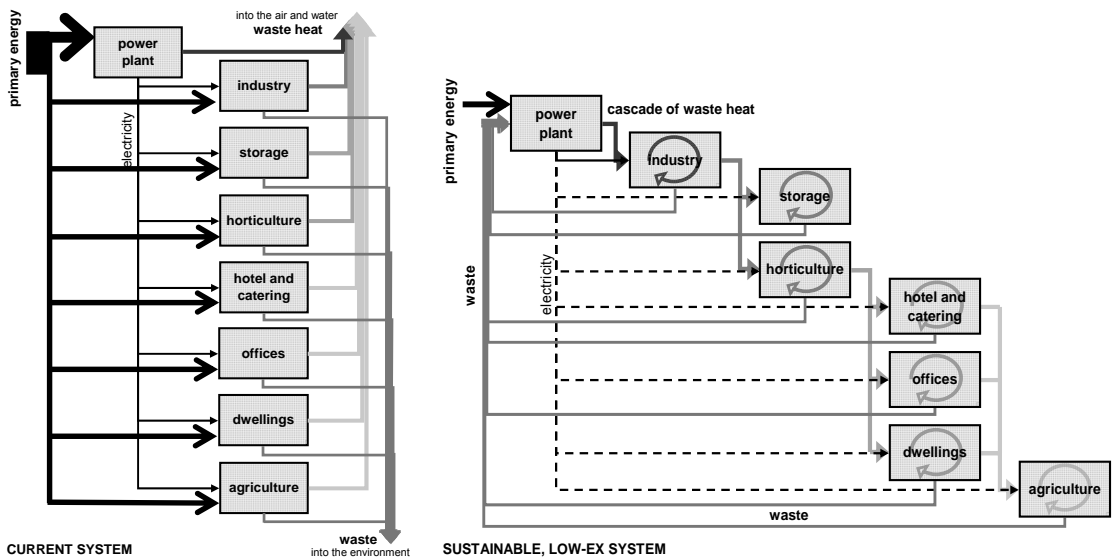


Figure 1 The traditional energy system versus a more sustainable one that uses waste heat optimally

As found in urban heat island studies [e.g. London Mayor, 2006], the accumulation and production of heat in urbanised areas is a problem that locally aggravates global warming. On the other hand, the Northern hemisphere still uses more energy for heating than cooling, so the available excessive production of waste heat should only be made useful. This is a question of having energy at disposal in the right quality, at the right time, in the right place. The built environment of the future therefore should contain means to convert, store and transport (waste) energy. Another approach might be to tune our spatial planning to the presence or demand of energy: locate heat demanding premises close to waste heat producing industries, or introduce a cold requiring (thus waste heat producing) facility in-between heat demanding functions. This can be considered low-ex planning. It's not the most efficient, but very effective.

2.2 Smart skins and solar energy

The second example of a reality-based promise concerns the immensely unintelligent way we interact with the environment, the climate, the weather. The built environment, buildings in particular, is predominantly static, be it winter or summer, sunny or cloudy, wet or dry. If we accept to learn principles of nature, we

will see numerous opportunities to design building envelopes that smartly interact between the indoor and outdoor climate, whilst generating and exchanging energy in an advanced way. Critical to the implementation of a changed approach to building façades in close coherence with integrated resource management in the urban living environment, are reciprocity between façade and surrounding influences respectively indoor comfort and behaviour related influences and climate change influences. Besides, inclusion of low-exergy solutions together with strong feedback systems between the different physical scales, and introduction of regenerative systems will be directive.

At the same time it is important to realise that there is enough solar energy in the world to fully provide our global economy with heat and electricity (and thus cold): we just need to make use of it, by deploying solar-irradiated surfaces more effectively (for energy, purification, nutrition etc.). Trying to prolong the fossil age is fatal: with the current demands for fossil resources, the limits may still be decades away, but when one of these limits is reached, the other resources would need to fulfil the demand for the depleted energy source. The impact would be a swift depletion of another resource, and so on. Nuclear energy is no enduring solution either, since Uranium resources are limited too, approximately 40 years with the current demand. Mallon [2009] calculated several scenarios of fossil age prolongation: each one of them had its limit within 75 years. This is why the depletion of fossil fuel should boost the development of new sustainable technology based on the only primary energy source we have: the sun, as well as its derivatives (wind, tides, biomass). It is abundant, ubiquitous and will be there for another 4.5 billion years. Recent developments in the market, whether ignited by large energy companies or by small-scale initiatives, are promising.

2.3 The existing stock and vigour

The previous two examples of the hope we may find in climate change and energy depletion refer to planning and design, whereas the predominant part of our built environment of the near future already exists. This should be considered as a great advantage: we don't need to build everything from scratch any more in the future. However we will have to reconsider more strongly the existing building stock and urban settings. Management of the built and unbuilt environment therefore is essential. E-novation (energy renovation innovation) will become a keyword and the main challenge to respond to the changing boundary conditions of climate and

energy. Instead of tackling buildings separately, the enormous assignment we take upon us will require an approach on a larger scale, with joint projects of neighbourhoods, districts and entire cities. Climate initiatives such as in Melbourne, London, Vancouver, Shanghai and Rotterdam illustrate this.

Cynical about the actual execution of the technical and spatial solutions? We think that change can be enforced or stimulated by inspiration and creativity. The people we mentioned at the start are the paragon of this. Profound understanding and a simple incentive can alter the way we approach our living environment. Vigorous legislation can transform the attitude towards sustainable solutions. One of the best examples perhaps is the German *Einspeichergesetz*, a law that ensures individuals and companies good prices for sustainably generated power, while taxing polluting, fossil fuel based energy provision. This policy has transformed the roofs of Germany and still does.

3. Outline

The three elaborate examples above are just three examples of many initiatives and ideas that relate to our preferred positive attitude towards climate change and energy depletion. There are many more, coming from scientists, inventors, designers, governments and the market. This book contains cutting edge work from scientists and influential planners and designers, which may give way to further progress into a sustainable direction.

Smart Building in a Changing Climate consists of three main parts – Regional and Urban Planning; Building, Skin and Technology, and Management and Transformation – each of which containing four scientific papers, swivelled by a special contribution from prominent experts in the area.

This main part is preceded by an appealing pamphlet from Dr. Ken Yeang.

We hope that through all ideas and findings presented in the book you as a reader will be inspired, challenged and incited to come up with personal ideas and projects.

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