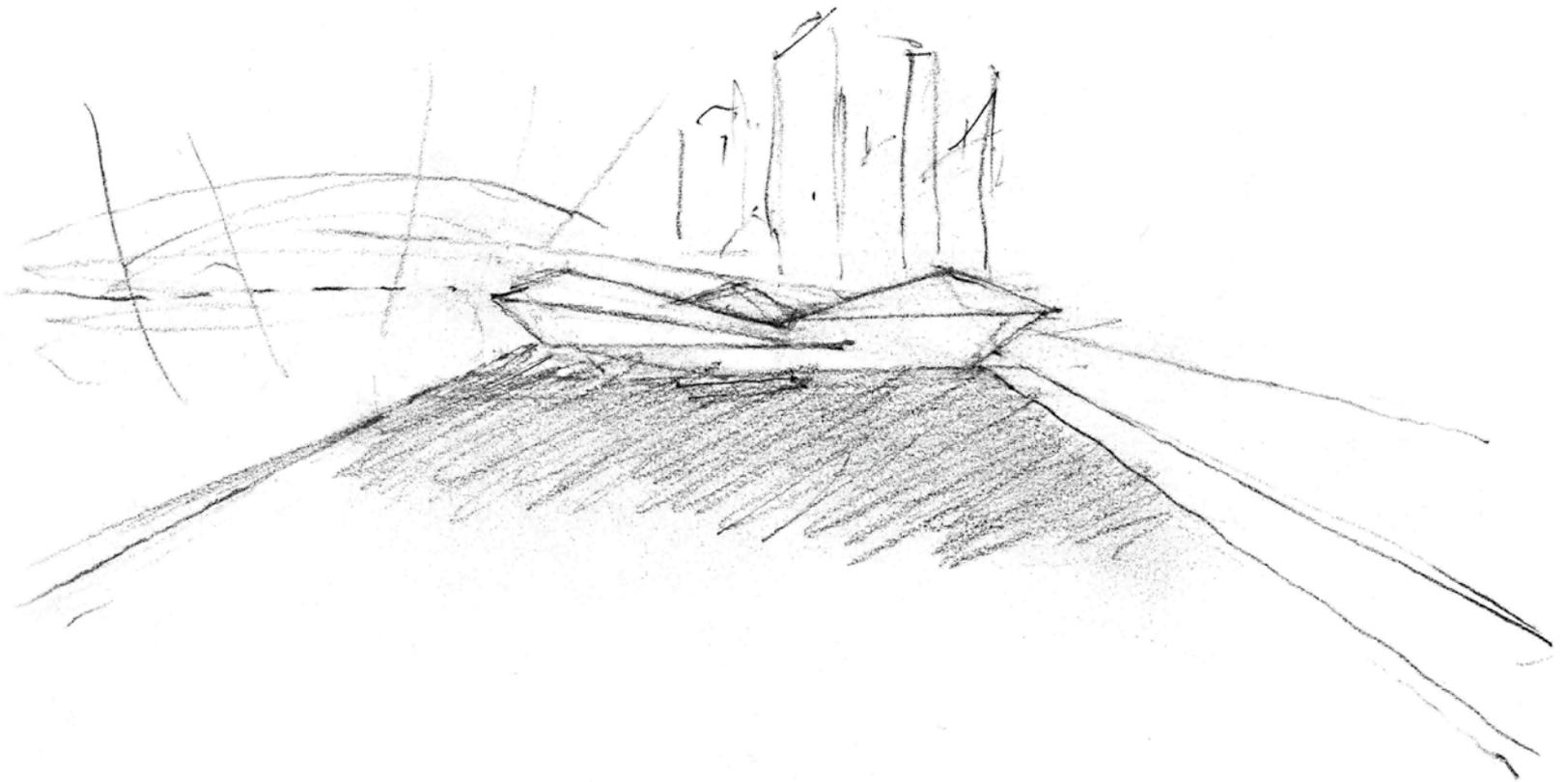


The Crystal

A landmark building for Technology and Innovation



THE
Crystal
A Sustainable Cities Initiative
by Siemens

Foreword from the editors

The development of this book and the way we tell the story about the journey of the Crystal from its concept to construction has involved the efforts of many people, all of whom were intimately involved in the design and construction of the building itself.

We have structured the chapters to highlight the intimacy between the bold vision of what is possible in building design and the translation of that vision into a reality that makes it a true icon that connects technology, innovation, sustainability and the community.

The content focuses on the evolution of the design process and how to make cutting edge technologies work together to achieve new levels of performance – not just exceeding standards – but driving building concepts to a new and higher level.

The interaction between architecture and technology, between passive and active measures and the collection and use of data to optimize building performance has resulted in a truly remarkable building.

Since its opening, thousands of visitors – architects, planners, designers, engineers, developers and builders – along with thousands of students and school children have come to see and understand the building. We hope it helps foster ingenuity and a new era of bold, innovative and sustainable thinking.

Enjoy the book!

Pedro Pires de Miranda

Juergen Loos

Martin Powell

Contents

Foreword from the editors	2	Building technology	69
Contents	3	Building automation	70
		Security	73
		Fire safety	75
Introduction	5	Monitoring	77
The first ambition	6	Efficiency monitoring	78
What makes a building sustainable?	7	Public displays	79
		Environmental features	81
Design	11	Site remediation	82
The creation of an icon	12	Landscape	83
The façade	20	Community garden	84
The structural form	24	Green roof	85
Natural cooling	26	Sustainable urban drainage	86
Daylighting & self shading	27	Transport – bikes and links	87
Insulation	34		
		Community	89
Energy	37	Royal Victoria Dock	91
Heating, cooling and power	38	New beginnings	92
Electricity	42	The Crystal in the community	95
Photovoltaic plant	45		
Lighting	46	One year on	99
E-vehicle charging	47	A lasting legacy	100
Heat and cold generation	48		
Domestic hot water and solar thermal	52	Appendix	105
Heat and cold distribution	53	Facts and figures	106
Mechanical ventilation	54	Installed Siemens products and systems	107
Natural ventilation	56	Relevant definitions	108
Location specific design	57	Awards and prizes	109
		Image credits	110
Water	61	References	111
Water supply	62	Acknowledgements	112
Blackwater recycling	63		
Rainwater harvesting	64		
Conservation	66		



Exploring tomorrow's cities today

Introduction

Design

Energy

Water

Building technology

Monitoring

Environmental features

Community

One year on

Appendix

The first ambition

Siemens set out to build the most sustainable building in the world. The aspiration was to meet the highest recognized standards of design achievement and the best ratings that the certification processes could offer, which would act as a symbol of world class engineering and would be a standard bearer for efficiency, quality and innovation.

Eighteen months later the showcase building and architectural icon opened its doors to the public, creating a new landmark for east London that would attract global recognition for design excellence and industry leadership in technological innovation.

The building is home to the world's largest exhibition on urban sustainability, an auditorium and conferencing facilities and also offices for Siemens' Center of Competence Cities – a team of experts whose emphasis on future cities is embedded in sustainable development and urban infrastructure.

The purpose of the building was to demonstrate the importance of cities in today's world, and the role that cities and their infrastructure have in creating a sustainable future. The building also demonstrates to a global audience the art of the possible in terms of engineering, technology and infrastructure.

The built environment contributes the highest percentage of greenhouse gas emissions globally and is a key focus for Siemens and its environmental portfolio. The design intent of the Crystal building is to provide a living and operational example of the importance of buildings, and how they can help alleviate the impacts of climate change.

London was chosen as the location for the Crystal because of its commitment to sustainability and advanced infrastructure as well as its far reaching policy frameworks to tackle greenhouse gas emissions from buildings. It is also home to a wealth of designers capable of achieving the highest standards in design innovation.



What makes a building sustainable?



In a world of increasing resource scarcity, buildings account for 40% of global energy consumption. Measures to significantly reduce demands on energy through building design and construction must be taken. Buildings have critical needs to ensure operational functionality and to provide a comfortable internal environment, but much of the energy used in a building can be eliminated through greater efficiency in design and systems, or by better understanding the operational needs to reduce energy waste. If buildings could be constructed to the highest standards of energy efficiency and technological excellence, global energy consumption would be reduced by over 20%. It is with this in mind that Siemens embarked upon what would prove to be a journey of pioneering design, innovative engineering and challenging project management.

Energy is not the sole focus of the building. The availability of water, and providing access to clean water is already at the heart

of conflicts across the globe. Our health is inextricably linked to this precious resource and in the UK alone, 10.5 billion liters of water are consumed in buildings every day, this equates to 4,200 Olympic sized swimming pools, an unsustainable volume if we are to ensure longevity in our water supply.

On a global scale, consumption at this rate cannot be sustained, and so tackling the water challenge through conservation strategies and new technology within buildings is a key feature of the Crystal.

Sustainability in buildings is also concerned with user experience. Often, when buildings are designed, usability and internal comfort are forgotten. In commercial spaces, where people can spend over eight hours a day, healthy environments are critical. Productivity and wellbeing are driven by internal environments.

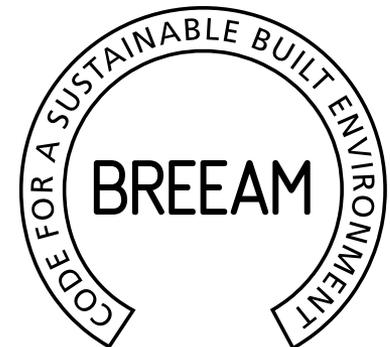
The materials used to construct a building are also a key consideration. The energy embodied in materials extraction, manufacturing, processing and delivery is said to account for 20% of building energy use. With efficient design principles, materials consumption can ensure avoidable wastage, costs and an overall reduction in global energy consumption. Sustainable buildings also have a role to play in supporting local ecosystems, avoiding harmful pollutants and becoming an integral part of the wider community.

To provide guidance to the project, and help frame the sustainability principles for the building, certification is critical. Building Research Establishment Environmental Assessment Method (BREEAM) the British certification process for sustainable buildings, and Leadership in Energy & Environmental Design (LEED), the American certification process, are the typical pathways for new buildings. To reach the highest ratings in either process, covering all necessary criteria, is extremely challenging and rarely achieved. It was decided that the building would aim for the highest ratings, and it would do so in both certification processes, an accolade never before achieved.

Balancing all these issues requires common understanding, a vision that is embodied in project management and team spirit, and a goal that is shared by all stakeholders. From the outset it was clear that, by having targets that would break new ground, the project needed a team that would provide a holistic approach to integrated design and delivery.

By undertaking this project, Siemens can better test and understand how to deal with some of the most pressing global environmental issues of current times. It can then feed this knowledge back to further advance its technological expertise and to allow for the delivery of advanced solutions to places where they are most in need – the cities that shape our future.

This book goes on to explain the story of the Crystal, its genesis, and its evolution, the lessons learned along the way and how the building has been received after one year of operation.



OUTSTANDING



