

Behnisch Architekten: New Directions in Democratic and Socially Responsible Sustainable Design Practices

JOHN REYNOLDS
Miami University

Firm Profile: Behnisch Architekten

Behnisch Architekten, originally established in 1989 as an affiliate office of Behnisch + Partner founded by Günter Behnisch in 1952, garnered world attention on its own accord shortly after it began functioning independently in 1991. The firm's predecessor, Behnisch + Partner, left an indelible mark on the postwar German landscape with a humanistic, democratic form of Modernism predicated on the notion of *Situationsarchitektur*¹ where design responses derived from the unique conditions of the place, the constellation of forces at work during the period of the design's inception, and the task. Notable projects from this office included the Olympiapark, Munich (1972), the Post and Communication Museum, Frankfurt/Main (1990), the Plenary Hall of the German Bundestag, Bonn (1992), and the office's last major project, the Academy of Arts, Berlin and Brandenburg, Berlin (2004).

Behnisch Architekten headed by Günter Behnisch's son Stefan has to its credit significant award-winning projects in Germany and abroad, most recently in the winning competition for the first science complex at Harvard University's Allston Campus (2006). Since 1991 under the name of Behnisch und Partner Büro Innenstadt, the firm added two additional partners in the Stuttgart based office of Behnisch Architekten and another in the LA based office of Behnisch Architects, Inc., established in 1999. Since the mid 1990's, the office realized major projects in both the public and private sector beginning with the St. Benno Secondary School, Dresden (1996), the

Central Administration Building for the State Clearing Bank, now LBBW, Stuttgart (1997) that with unbuilt prize winning competition activity as seen in the Harbourside Center, Bristol (cancelled 1999) and the National and Provincial Archives, Copenhagen (cancelled 2002) provided the developmental context for the featured case study projects. The Institute for Forestry and Nature Research IBN, now Alterra, Wageningen (1998) the North German State Clearing Bank on the Friedrichswall NORDLB, Hanover (2002), and Genzyme Center, Cambridge MA (2004) as case studies are noteworthy for their careful social construction in accordance with democratic design ideals and innovative sustainable design practices that characterize the firm's current orientation. Each case study project advances sustainable design as a form of 'assisted nature' linked to respect for the individual within a collective social and architectural framework, while paying particular attention to weaker design forces often overlooked or dismissed. Behnisch's democratic and socially aware sustainable design practices revision the normative understanding of the term sustainability to reflect its multiple dimensions. Extending beyond the technologies necessarily employed to achieve it, Behnisch positions sustainability as "the first institutionally driven, anti-theoretical movement in the history of the profession"² that "presented a sane alternative to the nihilism of the recent past."³

Sustainable Design Policy, The Aesthetics of Environmental Humanism and The Search for Democratic Order:

A uniquely European form of democratic environmentalism emphasizing social responsibility emerged in Germany and other locations such as The Netherlands and Scandinavia in the 1980's and 90's. This form of environmentalism combined scientific knowledge with human and social values in the spirit of an emerging environmental humanism characterized by Philip Regal as implying "insight into patterns of connectedness among individuals and institutions and with the non-human environment."⁴

In Germany, public consensus to respond to the challenges of the Rio Declaration Agenda 21 and its call for an integrated sustainable development approach grounded in social and economic considerations and the Kyoto Summit's aim to reduce greenhouse gas emission levels in 38 industrialized nations to 1990 levels brought about significant political change through the influence of the Green Party. Environmental legislation such as the Low Energy House Rating (1982-Revised 1999) that reduced the upper limit on domestic energy consumption from 150 kWh/m²/yr. to 65 kWh/m²/yr., and the Thermal Performance Ratings (2002) that applied these regulations to all new buildings⁵ were projected to yield an annual 10 million ton reduction in German CO₂ emissions by 2005.⁶ These legislative initiatives and the more dramatic Passive House Rating aimed at reducing residential energy consumption to 15 kWh/m²/yr and 'zero energy' projects⁷ frame the domestic political climate within which the Behnisch practice originated and now currently operates. This environmental legislation fostered an unprecedented shift on the part of architects, developers, clients, and civic authorities towards more effective collaboration on sustainable design issues grounded in politically sanctioned social responsibility.

In accord with the value structure long advocated in his father's office and seen in the oeuvre of the current Behnisch practice, Architecture through its social construction, reflects an idealized democratic social order where the individual within the collective is cared for in a respectful way. Typically, if a choice has to be made, Behnisch tends to the

needs of the individual and the 'underdog', such that the individual can see that great care has been taken in dealing with their concerns. Behnisch's commitment to the individual means that a comprehensive view of the individual's needs must be taken and responded to in a complex and varied way.⁸ Architectural order in this 'humane' form takes on heterotopic⁹ qualities characterized by openness, informality, situational responsiveness and aesthetic imperfection.¹⁰ Design aesthetics and building technology are to respond to the needs and the corporeal identity of the user. As Behnisch explains in his characterization of the IBN project:

"The building is not what by conventional standards one would call beautiful. This deliberate aesthetic imperfection is an appeal to the unmediated, primarily sensory experience of architecture."¹¹

Thus, Behnisch avoids dominant representation and architectural ordering systems with an over emphasis on hierarchical spatial organizations. The Humanism, democratic values, and non-hierarchical space found in the work of Herman Hertzberger, Aldo van Eyck, and his father Günter Behnisch's projects at Munich and Bonn with their polemical and political content, while still evident in the work of Behnisch Architekten, is more understated.¹²

These social aspects coupled with the careful attention paid to the sensual dimensions of architecture and their intertwining with human experience and memory comprise what Stefan Behnisch characterizes as the 'soft' aspects of architecture that "constitute the rank and significance of a work of architecture"¹³ It is these 'soft' aspects that establish the arena within which sustainable design practices are positioned. Behnisch's Genzyme Center (2004) clearly demonstrates the important role of social construction within architecture resulting from both the client's and Behnisch's desire to democratize the work place. Both Behnisch and the client understood the opportunity for design to play a role in the enfranchisement of employees, acknowledging their need to be both part of a research culture and corporate body politic, while addressing their desire for autonomy and individual expression. The vertical garden sequence, urban boulevard circulation system, 'neighborhood' office structure, tea kitchens, and small scale

meeting and breakout spaces among others, provide a rich, collective social and spatial fabric that inscribes the individual work place while respecting the autonomy of its arrangement, environmental control, and expression.



Fig. 1. Genzyme Center Atrium

At the virtual center of this sequence is the atrium or *Halle*,¹⁴ a remarkable social achievement that occurs at the intersection of the building's major spaces and systems. The atrium at Genzyme provides a locus where relations among the affected research communities, staff, and the public are developed and expressed in a sensually sophisticated spatial context imbued with democratic values.

Sustainable Technology, Social Construction, and The Politics of Comfort:

Behnisch advocates a 'middle of the road' position with regard to developing and employing both 'High' and 'Low' Tech sustainable environmental technologies. In recent work such as the NORDLB project, Hanover (2002) one finds High Tech systems such as computer-controlled heliostats and sun protection technologies paired with geothermal heating and cooling combined with natural

ventilation strategies. As Stefan Behnisch has written:

"There are basically two schools of sustainable architecture. The Norman Foster School, where environmental problems are solved by bringing in technology; and the Soleri School which rejects technology. We fall somewhere between these two; but my sympathies are more towards Soleri. I don't want to go back to the stone age, or change the way we live now-but so long as we are prepared to accept that we will be warmer in the summer and cooler in the winter, than I am convinced we can achieve an acceptable level of comfort by following the laws of nature."¹⁵

Building users, through environmentally sensitive, anti-consumptive behavioral tendencies and patterns encouraged by the architect's design practices offer a profound opportunity for positive change that adds ecological value to architecture extending far beyond the development of a green building program. As Stefan Behnisch explains:

"in short, it can be stated that the dwellers or users of the buildings we design are also challenged. In particular, they should learn that a low-energy building or an ecologically sensitive building requires a certain behavior and also certain restrictions which seem to challenge the much emphasized comfort. A new definition of comfort has to be found and disseminated. This is essentially a political process which is hardly within the influence of the planners and should be promoted by opinion leaders."¹⁶

Respecting building users, enfranchising them within the building's democratically conceived social fabric gently empowers them to adopt positive, environmentally sound practices in their workplace environment rituals and daily activities. The IBN project, Wageningen (1998), provides a ready example. Researchers in the office wings control their own ventilation, temperature, and daylighting preferences through direct contact and exchange with the internal circulation gallery and garden spaces adjacent to their offices. The garden space, with its roof enclosure comprised of a standard horticultural glazing system, experiences more dramatic temperature fluctuation than a normatively conditioned atrium space. However, the effect

and direct experience of seasonal change actually increases the researchers' engagement with the space and each other as it quickly became a favorite place among employees for research, discussion, and pleasure despite the reality of making modest adjustments to their dress habits. Thus, a positive social pattern increasing engagement among the researcher cohort, as they adjust their office microclimates and move about the building, realizes important professional, social, and environmental objectives. The most noteworthy outcomes from this design sensibility include a greater exchange of information and ideas among employees, increased employee satisfaction, and a reduction in employee turnover. Attention paid to employee wellbeing and provision for their environmental autonomy from an economic and environmental standpoint, parallel markedly simpler heating and ventilation system design that eliminated most mechanical air conditioning systems.

Constructing Environmental Connections through Human Experience and Perception:

Behnisch understands that architecture and landscape have the capacity to issue invitations that encourage users to engage their environments at a more intimate level. The rich sensual dimensions of Behnisch's projects are essential to place formation and its affinity to human experience and memory. The urban courtyard of the NORDLB project with its three lakes and adjacent employee restaurant reflects the local predilection for lakeside dining and socialization. Observation of this important social tendency underpins key environmental concepts involving air purification, passive cooling, and ventilation that, in their sensuality, evoke personal memories and hermeneutic associations with such references as The Garden of Eden. The atrium and vertical gardens at the Genzyme Center also call to mind multiple associations in this regard. A vertical garden sequence emerges from the public architectural landscape of the ground floor, articulating the spatial character, social construction, and environmental system paradigms of the building. Other notable projects¹⁷ such as the conceptual design for the Senscity Paradise Universe, Las Vegas (2004) began with the exploration of the atmospheric and

environmental dimensions of natural places. Gardens, groves, valleys, hillsides, plateaus, lakeside and river terraces etc., provided the foundation for the project's emerging spatial identity as an architectural landscape with corresponding environmental concepts developed around these associations with place. Metaphorical allusion to flowers and trees extended beyond the symbolic as careful attention was paid to their inherent natural capabilities with respect to solar shading, water dispersion, and radiant cooling.

Recalling one's own landscape experiences and memories encouraged through the building's sensual dimensions have the capacity to serve as mnemonic stimuli, that encourage individual engagement with its spaces, environmental systems, and other users. At the IBN project, art Interventions add additional layers of experience and meaning to the gardens. Artist Michael Singer designed the pools, watercourses, paving of the main access, arbor, and the building's main circulation path that, in addition to their aesthetic value, are an essential part of the building's environmental system, particularly with respect to evaporative cooling. Intertwining the building's socially constructed spaces with its environmental systems established a sense of place and time through vegetation development and material surface treatments. Singer effectively placed the suggestion that the building was built around the interventions "as though some mysterious archeological site had been unearthed there."¹⁸ Avoiding the nostalgic, Singer's interventions foster deeper involvement between the building as collection of living systems and the user.

The Institute for Forestry and Nature Research IBN, now Alterra, Wageningen (1998)

Client and Mission:

In an effort to merge the Forestry and Urban Ecology and Research Institute for Nature Management institutes and their three hundred employees, The Dutch Ministry of Housing, Spatial Planning, and the Environment (VROM) invited three architects¹⁹ in 1992 to develop architectural proposals for a new Institute specializing in "solving problems of the natural environment through an integration of ecological expertise and an understanding of

social science."²⁰ As part of a European Union pilot project exploring building ecology, design process, and user well-being, the institute's mission is to provide scientific support for nature conservation and nature management research that examines methodologies for making ecologically sound, sustainable use of the natural environment.²¹ As an expression of the principles of sustainable architecture, and "a living organism"²² it was highly desirable that the building have substantial capacity to self regulate temperature and water use as it responds to daily and seasonal temperature and precipitation cycles. Characterized by Stefan Behnisch as "Humanistic Construction"²³ and a "A Low Tech Building with a High Tech Result"²⁴ the challenge, as viewed by Behnisch, was to integrate ecological concepts that addressed the aims of the Rio Summit²⁵ beginning with an evolutionary regeneration of IBN's environmentally compromised agricultural site, without dominating the project and exceeding normative financial constraints.

Site Concept:

Behnisch's site concept positioned the building as a "Green Island"²⁶ with surrounding gardens that linked existing greenbelts currently defining the northern edge of Wageningen. Beginning with a few existing landscape elements, Behnisch avoided site 're-naturalization' in the sense of 'wild' or pseudo-natural design but wanted to "enable nature to develop on its own in the course of the forthcoming years and decades"²⁷ while restoring the soil previously exhausted by intensive agricultural use. The aesthetic qualities derived from the surrounding landscape and new, subtle site interventions. A marshy reed garden and raised pond to the north supported soil remediation and served as a reservoir and water purification system for rainwater. Raised gardens, sharing similar proportions with the internal gardens and framed by dry stonewalls that served as habitats for birds, insects, and other small animals merged the building with site.

Building Philosophy and Concept:

IBN, described as a "a principle versus image driven building,"²⁸ advances relationships between people, plants, light, air, space, heat, and water.²⁹ Organized along a spine, the 'bar

with wings' or 'E' shaped plan type inscribes the internal gardens between each wing that comprise the ecological, spatial, and social center of the 10,000 square meter building. Laboratories occupy the north bar and connect to finger-like office wings that extend southward containing the research offices and ground floor public program such as the library, meeting rooms, and cafeteria that extend out into the covered gardens in between. This 'spine with wings' parti provides for expansion and each wing can attain discrete spatial autonomy should it become a future consideration.

The building's spatial and social vision, as noted in the post competition brief, was to be varied and dense "similar to that of a small town, with squares, paths and parks, with public and private areas and transition zones."³⁰ Understated in their formal complexity and simplicity, the building's gardens became the major interior spatial events that establish the environmental and social construction concepts, ironic given the fact that they were not part of the competition program but boldly added later by the Behnisch team. Research offices face the internal garden and are accessible from an interior corridor and exterior gallery with widened handrails acting as a 'leaning boards' for increased socialization and informal contacts among employees. Roofed with greenhouse glazing typical of the region, the internal gardens, extend southward into the landscape order about the building and vice versa, while maintaining lateral visibility through the relative transparency of each wing. A remarkably efficient building results through spatial compactness and optimal volume/envelope ratios that, in addition to its east-west orientation, allows for maximum solar benefit, balancing the reading of building form and ecological concept.

Ecological Concepts:

Creating a low energy building was a goal from the earliest planning stages. Energy calculations of the early schematic proposal revealed consumption at 40kW/h per cubic meter, including the labs that positioned IBN considerably lower than the normative office building at 120 to 180 40kW/h per cubic meter.³¹ Building ecological principles focused on three major areas aimed towards:



Fig. 2. IBN Interior Courtyard

1. Reducing Energy Consumption and Material Embodied Energy³²

Implement Passive Solar Energy Strategies: Glazed Atriums as Climate Buffers

Considered by the local code authority as 'roofed exterior spaces' the gardens are not subject to the same controls as building atriums and thus can function as ecological heating and cooling devices for the interior. During winter, the gardens act as insulating buffer zones and passive solar collectors. Adjustable foil-covered heat reflecting sun blinds beneath the standard single-glazed Dutch horticultural greenhouse roof system are open to maximize solar gain during the day and closed at night to reduce heat loss by radiation. Monitoring indicates that ambient air temperature in the atriums does not drop below 0 degrees Celsius and has yet to drop below 5 degrees Celsius for over 100 hours. Closed as required on summer days with provision for lateral ventilation above the blinds to reduce excessive direct solar gain, the blinds open at night allowing the atrium to function as a thermal chimney. The sun protection blinds beneath the skylight, consistent with standard green house technology, limit summer temperatures to 28 degrees Celsius when coupled with intensive night ventilation. A system of natural air conditioning occurs when intake air admitted through the north façade is drawn under the laboratory wing and cooled further by the vegetation in the gardens, pools, and watercourses through an evaporative cooling process. Evaporation from foliage estimated at 6,000 liters/day, with additional evaporation

from the water feature, generates a cooling capability of 20,000 kilowatt-hours, lowering interior garden temperatures by several degrees Celsius and naturally humidifying the ambient air.

Utilize a Highly Efficient Thermally Insulated Envelope

Thermal buffering accomplished by the gardens allowed for large expanses of glass to be employed at their southern exterior façades. High-grade heat insulating glass selected for the office facades faces the gardens and super glazing systems at the north. For the interior garden façade application, a Larch window wall system encloses 2/3 of the developed atrium façade length and, at the exterior, a Robinia window wall system with fiber cement spandrel panels sheathes wing building envelopes at the east and west. Masonry with a multi-hued layer of insulating plaster at the north façade achieves visual integration with the environment through its color and surface quality, while providing thermal performance suitable to its northern orientation.



Fig. 3. IBN South Facade

Minimize the Technical Plant: Heating

In each functional area, a modest heating system met the anticipated heat energy requirement of approximately 40kWh/cubic meter. Exhaust air extractors located in the middle of each office wing operate on sub-atmospheric pressure and stimulate air movement through the offices. Heat recovery feeding exhaust heat back into the building reduced the heating requirement in the offices

to 30kWh/cubic meter resulting in significantly lower building operations costs. At the roof of the north wing, a direct heat recovery system with each space assigned to a vertical shaft in the corridor allows staff to adjust ventilation levels and reduce heat energy consumption by 60 percent. Since off-site distance heating was not available and geothermal heating and cooling was not an option due to water table considerations, natural gas became the preferred heating medium. Using a low temperature heating system in the floor downgraded the need for ductwork and contributed to an on average 30 centimeter lower floor-to-floor height that reduced building volume and costs.

Minimize the Technical Plant: Cooling

Modest air conditioning interventions in the Kitchen, Library, and Laboratory wings, kept system design to a minimum. Comfort in the two atriums, achieved through natural air conditioning concepts, evolved from the interplay of the greenhouses, vegetation, water surfaces, and natural ventilation. Activating internal storage masses through nocturnal cooling on exposed ceilings eliminated the need for most mechanical cooling and further contributed to, despite the floor-to-floor height reduction, an actual average effective ceiling height increase of 20 centimeters. Localized sun shading, lateral ventilation in the atrium roof zone, individual sun shading on windows inside and outside the atrium, and a summer air-channeling system further reduced cooling loads. In the lab environments, air conditioning equipment exposed on the ceilings that utilized a non-cfc ammonia based refrigerant actuates summer nocturnal cooling. Encouraging user autonomy to operate the sun protection and ventilation systems, with the use of the atriums, reduces the technical plant while enhancing social contact and respecting the individual's needs.

Use Materials with Low Embodied Energy

Behnisch made use of industrially manufactured products as much as possible to avoid waste and minimize energy use. The design team weighed the environmental impact of selected materials considering energy expended during extraction, manufacture, transport, installation, demolition, and recycling. For example, strip laminated short sections used for wood window wall systems and manufactured on site saved timber while

minimizing transport's negative environmental impact and cost. However, an innovative heavy timber composite floor structure proposal met resistance and eventual abandonment due to fire codes. Some materials with initial negative environmental qualities, such as the galvanized steel used in the gallery and horticulture roof system structure due to their zinc content, when analyzed and environmentally balanced as systems with other materials, benefited the architectural outcome through their discrete use.

Develop a Comprehensive Daylighting Strategy

At IBN, daylighting replaces artificial illumination where and whenever possible. All spaces have windows or large expanses of heat protected (offices) or super glazing (north wing) high transmission glass with high transparency and low energy transmission that provide illumination from the exterior or the central atrium. Each office space holistically integrates individualized glare protection and sunshading into its interior design. The laboratory wing incorporates a transparent heat-insulation system that enables daylight to penetrate spaces to a depth of 7 meters. Atrium floor surfaces, columns, and parapets rendered in a light color ensure adequate daylighting on the ground floor rooms that on average have a daylighting quotient of 9 percent with 1 percent achieved at the center of the room.

2. Reducing Water Consumption ³³

Implement Grey Water Circuitry

A grey water circuit collects sufficient rainwater from the garden roofs to handle toilet flushing and cleaning functions. Excess rainwater directed to, and purified in, a marshy reed returns to the natural water cycle. After warming in the atrium garden pools, this grey water becomes the irrigation source for garden vegetation.

3. Avoiding Materials with Negative Environmental Impact and Planning for Building Recycling ³⁴

Select Renewable and Recyclable Environmentally Responsible Materials Whenever Possible

Consisting of 'Elementary Character' materials that were renewable (wood) or recyclable (steel, glass, concrete), major building systems such as the roofs, floors, walls, and structure directly expressed on the building's interior eliminated the need for environmentally degrading envelope veneers, suspended ceilings, and interior partitioning systems. At the level of finish, environmentally stable lacquer and solvent-free paints were the coatings of choice. Made of wood and, in the case of the beech wood desktops, impregnated with vegetable oils, elements such as doors and handrails took the user experience into the olfactory dimension. Application of natural stains or beeswax on interior wood surfaces, while considered, failed to meet demanding fire code criteria. Other surfaces such as the interior floors proposed as mini-strip parquet necessitated a synthetic varnish, so in its place the design team selected a factory finished beech wood floor.

**The North German State Clearing Bank
NORD/LB on the Friedrichswall, Hanover
(2002)**

Client and Mission:

Since its completion in 2002, the Norddeutsche Landesbank Headquarters (NORD/LB), an 840,000 square foot/80,000 square meter administrative center for 1500 banking employees, redefined the nature of financial institutional architecture in response to dramatic change within the banking industry. Domestically, NORD/LB functions as the state clearing bank for several federal states while simultaneously serving as the central bank for others, in addition to its worldwide international banking operations. In a broader context, NORD/LB administrators wanted to demonstrate how design at multiple levels in a socially and environmentally responsible manner enhances relations between the bank, its employees, the community, and The City of Hanover while creating a fresh response to the changing nature of work.

Site Concept:

An important link between Hanover's residential and commercial districts, the NORD/LB headquarters building promotes engagement with the public while

acknowledging the security concerns of a modern banking center. Building and site planning tactics refer to historic downtown geometries instead of the orthogonal grid of the of the post war city. NORD/LB's extroverted formal response and multiple orientations connect it with the surrounding urban fabric, actuating human activity inside the courtyard and around the building. To the west of the site is the City Hall and Maschpark. The Aegientorplatz at the northeast corner of the property is an important traffic juncture within the city and the Theater am Aegi on its eastern side initiates the transition zone to the Maschpark. Located along the Friedrichswall, built as a ring road on the site of city's ancient fortifications that forms the northern edge of the site are Hanover's shopping, work, housing, culture, sport, and leisure activities activates this edge. Connected at multiple points to the aforementioned site conditions, the NORD/LB's inner courtyard mediates site forces through design intervention in the form of three expanses of water or 'lakes', landscaped roofs, terraces, paths, restaurants, shops, cafes, and a gallery. In effect, the courtyard has qualities of both an urban square and artificial park landscape that establishes the transition from dense urban settlement to the green of the Maschpark.

Opening at various points in response to urban conditions, the perimeter block that surrounds the courtyard and central tower varies in height from 4 to 6 storeys, inflecting the building massing to address site forces such as the inclusion of the restored 19th c. historic Siemens building. As an alternative form of City Square, the internal courtyard while serving as the building's lower level, in actuality belongs to the city. Banking functions take place in the upper levels of the perimeter block and the tower. Access from the street to the multi-level entrance *Halle* at the center of the site occurs through a semi-public forecourt



Fig. 4. NORD/LB Interior Courtyard

or gateway that occurs opposite the semi-private courtyard. Situated in close proximity to the *Halle* the staff restaurant and cafeteria, and a forum for gatherings and exhibitions encompass ground level public functions. The 4-level atrium or *Halle*, like the gardens at IBN, functions as the social and ecological heart of the building. Rising from the *Halle* to a height of 80 meters/230 feet, the tower directly relates to the city hall dome making a contribution to Hanover's skyline, eliciting its reading as a Late Modern "Stadtkrone"³⁵ or "mini-metropolis".³⁶

Building Philosophy and Concept:

Responding to the situation and the nature of the task in the spirit of *Situationsarchitektur*, the NORD/LB, through its site planning, formalism, ecological concepts, spatial



Fig. 5. NORD/LB Exterior View

articulation, and transparency advances exchange externally with the city, and internally among bank employees. The social construction of the building is apparent in the courtyard, atrium, and arrangement of informal meeting places. Multiple floor plan variations afford varied individual, cellular, and team working configurations that intertwine the building's spatial and ecological concepts.

With origins in the Behnisch + Partner Diakonisches Werk building, Stuttgart (1984) and Behnisch Architekten's State Clearing Bank, now LBBW, Stuttgart (1997) and pointing towards the recent Genzyme Center, Cambridge MA (2004), NORD/LB in particular illustrates important development and refinement in the building's social configuration and integration of green technologies. The building's spatial network recalls the urban ideas of the Diakonisches Werk with vertical circulation in the character of major and minor streets linking spaces akin to small urban squares all anchored by the atrium as the main square. Beginning with the public ground level and its atrium, the sequence extends into the semi-private mid level office and work spaces of the perimeter block to the more private offices, meeting rooms, executive dining rooms, and boardrooms of the tower.

Additionally, the 'building-as-landscape' and transparent inside-outside connections as seen in the ground floor of the LBBW recall the spirit of democratic landscapes dating to the Olympiapark, Munich (1972). Behnisch notes this predilection for building-landscape synergy at NORD/LB as he elucidates:

"In our opinion it was important to develop an unmistakable formal language for the functions of the external areas and to respond to the clear character of the architecture. We did not want to express the landscape architecture as an element of its own. The objective was to merge it with the building and to create close relations between interior and exterior."³⁷

The inference of the ground level plan as an artificial landscape, with features such as the green staff restaurant roof operating as a meadow floating above the water, calls to mind the freedom, sensuality, and ephemerality of experiences in nature. Concurrently, developing 'architecture as landscape' provided the design team with opportunity to realize

important sustainable agendas related to thermal performance and water conservation. When considering Behnisch's approach to landscape and his desire to create flexible workplaces for their transitory human activities becomes apparent in the uniqueness and multiplicity of his spaces and office plan types. Open and accommodating to change in their flexible structure and configuration, they approach the organic. Stemming from this diverse approach, the building's ecological concepts take on a new vitality reading as natural extensions of building's emerging organic sensibility versus a series of applied environmental technologies to enhance building comfort and performance.

Ecological Concepts:

Behnisch's design team and the client wanted to have an ecologically sound building while avoiding the appearance of "a green building with an exclamation mark"³⁸. Utilizing natural resources including the sun, wind, and outside air while reducing ventilation, cooling, and lighting costs were paramount behind the ecological systems objectives that focused on the following three areas: Geothermal and Natural Ventilation Systems, Daylighting and Solar Protection Systems, and Enhanced Façade Performance. Photovoltaics and an in-house electricity station were rejected on cost-benefit economic criteria, however solar panels deliver the energy required to supply the kitchen with hot water.

1. Geothermal and Natural Ventilation Systems³⁹

Geothermal Heating and Cooling

In general, while geothermal systems technology is not new, it is atypical and remarkable for a building as large as NORD/LB. Heat exchanger tubes in the building's 1,220 foundation pilings heat or cool water as required. The water then circulates through polyethylene pipes in the building floor structure to activate the floor slab as a thermal mass. Performing as a thermal storage bank, the geothermal system balances heat supplied to the ground during the summer and extracted from it during winter.

More specifically, heating at NORD/LB occurs as circulated water at 6°C/42°F moving through a soil heat exchanger and boosted to 30°C/86°F by means of a high performance heat pump warms the thermal storage mass of the exposed ceiling to a temperature of 24°C/75°F. Conventional zone heating compensates for lower temperatures near the windows. Hanover's moderate climate with temperatures exceeding 22°C/71°F only 5 percent of the year positions geothermal cooling as an attractive and energy efficient alternative. During the summer, cold ground water pumped from 20 meters/66 feet below the ground, (1.8 meters/6 feet below the water table) circulates through the system at a temperature of 18°C/64°F creating a cold ceiling surface without refrigeration while removing heat and re-circulating the 25°C/77°F water to the heat exchanger and eventually, to the soil, for winter extraction. The ceiling slab cools the ambient air over time throughout the day. The only electric power required in the geothermal system stems from the circulating pump that balances the amount of heat admitted to, and extracted from, the soil.

Natural and Assisted Ventilation

Ventilated individually with operable windows, all rooms use the conditioning potential of the outside air. Each employee controls temperature and ventilation through operable windows. Outside air admitted at the typical office window flows through an air link or 'flap' into the corridor. There, air collected and conducted to the roof through shafts in the corridor separation walls via natural suction or the chimney effect, receives mechanical assistance only as required by low energy ventilators. This method effectively achieves five air changes per hour in the offices at night using the night air to cool the building. Air cooled evaporatively from the inner courtyard and channeled underneath the building circulates through the double façade during the summer months as a means of mitigating solar gain on affected facades.

2. Daylighting and Solar Protection Systems⁴⁰

At the scale of the courtyard, a computer controlled Heliostat and fixed mirror system similar to that at LBBW brings light into shaded

areas where direct sunlight is desirable. Additionally, extensive daylight and shadow simulations guide the daylighting capabilities of the heliostat system as it pertains to the natural illumination of the atrium space. At the scale of the typical office and at the control of the individual, an innovative solar blind system admits daylight through adjustable inverted upper blinds and directs it towards the reflective ceiling, enhancing the amount and quality of natural light as the lower blinds alleviate excessive daylight and solar gain.

3. Enhanced Façade Performance⁴¹

The Friedrichswall, Willy Brandt Allee, and Theater am Aegi facades, as well as the south side of the tower, have double facades for climate control and sound insulation. Computer simulations that considered orientation and surrounding context issues directed the design of the façade window openings, including the protective foil dot patterns applied to the glass and the design and configuration of the attenuating sunshading devices. The upper façade region of the gradually dematerialized tower employs 'interference glazing' panes with vapor applied metal coatings to reflect the light in yellow and blue tones according to the position of the sun that, in turn, produce a dynamic effect of light and color.

Ecological Concept Outcomes:

Carbon Dioxide reductions calculated by Behnisch's energy consultant Transssolar⁴² were significant and revealing, totaling 1920 tons per year. Rigorous ventilation, cooling, solar protection, window, heating, and artificial light coordination reduced energy consumption significantly. Through the use of controlled used air with thermal impulse, the regenerative production of cool air and daylight technologies realized the largest CO₂ reduction at 1500 tons. Supply technology as demonstrated in 'district' heating achieved a 400 ton CO₂ reduction, followed by the 20 ton CO₂ reduction realized by the incorporation of 180 square meters of solar panels.

The Genzyme Center, Cambridge MA (2004)

Client and Mission:

Genzyme, a leading multinational biotechnology company founded in 1981 specializing in the treatment of rare genetic

diseases, genetic testing, and diagnostic research, displayed a strong social consciousness in the design of its headquarters building at Kendall Square in Cambridge. Through an inclusive design process, Behnisch Architekten and Genzyme advanced sustainable architectural design and corporate democracy in a manner that mirrored the company's socially responsible policies. Recognized by the U.S. Environmental Protection Agency, the American Association for the Advancement of Science and numerous business and scientific journals for accountability to its employees and corporate philanthropy, Genzyme also garnered admission to the *Dow Jones Sustainability World Index* for excellence in economic, environmental, and social performance. Genzyme's accolades, symptomatic of its humanist orientation, contributed to a remarkable synergy with the design team that carried over into project design and construction resulting in a headquarters building that would receive international acclaim for design excellence while achieving a U.S. Green Building Council platinum rating.

Site Concept:

initially overlooked due to its status as a hazardous waste location, close proximity to MIT, Harvard, and the Charles River, near Kendall Square made Genzyme and its associated ten-acre master plan site, one of the few remaining suitable parcels in this area of Cambridge. Encompassing more than 1.3 million square feet of program among seven buildings, the master plan intended to activate the entire precinct through a mix of lab and office space, retail, theater, hotel, and residential uses of which fifteen percent had to meet affordable housing criteria. Parks, boat landings, and an outdoor ice-skating rink established the initial trace of an emerging public realm. Individual design competitions guidelines required the establishment of links between Kendall Square, Cambridge, and Boston while simultaneously increasing public engagement at the individual building level through minimal setbacks and pervasive ground floor transparency.

Building Philosophy and Concept:

A Radical revision of the normative North American office building type with four times the amount of common space per employee,

the 250,00 sq. ft. Genzyme headquarters, merges social construction principles, environmental quality in relation to human experience, and responsible energy use within a democratic planning framework. From the standpoint of democratic practices, the atrium acts a social condenser for Genzyme's 900 employees that promotes collaborative engagement among staff with group workspaces situated around the atrium that affords opportunities for visibility and communication.

Pervasive horizontal and vertical interconnection allows for vertically as well as horizontally organized local office communities. Beginning at the open and accessible ground level, the main circulation system around the 12-storey atrium's edge threads through the diverse spatial configuration of Genzyme evoking the suggestion of a 'city within a city'. Building program and circulation systems bear analogous resemblance to districts, neighborhoods, boulevards, streets, squares, and green spaces. Thus, the major circulation system reading as 'boulevard', atrium as 'Main Square', and main office spaces as 'districts', etc. further extend this analogy. In addition to the opportunity for informal contact in the gardens, at the corridor or 'street level', small coffee bars and kitchenettes add an intimacy to the quality of the building's social fabric, whereas the sky level cafeteria affords employees views of the city once reserved for senior administration. Genzyme's urban temperament and emphasis upon respect for the individual while empowering a collaborative small group working dynamic, offers another reference to Hertzberger's *Centraal Beheer* and shares spatial and dimensional qualities with the interior of MVRDV's *Villa VPRO*. Vertically urbane, the superimposition of the green garden network encourages social life and counteracts any unwarranted vertical overemphasis as the environmentally active atrium and gardens intersect public and private spaces, conference rooms, the cafeteria, and library as they organize light, air, sociability, and circulation.⁴³

The Genzyme building advances democratic ideals beyond spatial and functional considerations through the free actions of autonomous building users as they engage environmental systems in a direct way. As per Günter Behnisch's *Diakonisches Werk* (1984), individuals attune their work environments

through direct control of ventilation, daylighting, sun protection, and artificial illumination, imparting diverse readings to the building's exterior appearance. Building envelope elements freely engage the building's largely transparent interior and vice-versa with polychromatic window treatments and office partitions offering multiple readings when viewed through a multilayered façade. Genzyme's permeability and transparency while aesthetically gratifying, achieve a real as well as symbolic transparency when one considers the experience of the building envelope and its connection to the largely unpartitioned deep space within. Humanely averse to large architectural statements while preferring multiple smaller, open, design gestures and details, Genzyme remains 'aesthetically imperfect' in an attempt to enfranchise the user within its democratically considered spatial matrix.

Ecological Concepts:

For Behnisch Architekten, technology is a "living thing versus a mechanistic determinant."⁴⁴ Despite strong emphasis within the Behnisch design culture on the innovative application of environmental technologies, technology is understood in a phenomenal versus abstract manner with significant sociological and human experience implications. As a constellation of interconnected systems, environmental technologies and the building's 'respiring' envelope are freely combined into a spatially open and flexible building that resists closed and formal structures as it "foregrounds the human subject in its skin".⁴⁵ Behnisch's approach to environmental technologies while socially-inflected and experientially focused, expects to yield serious reductions in energy (30 percent) and water (25 percent) use when compared with normative office buildings.⁴⁶

The Atrium

Genzyme's ecological concept centers around its 12-level atrium. Described as a "climatic oasis,"⁴⁷ the atrium develops vertically in a way reminiscent of a tree with limbs and branches that extend through the building from the center outward towards the exterior. Essential to the building's natural ventilation system, the atrium functions like the human lung and respiratory cycle acting as a huge return air duct and light shaft. Fresh air, admitted into

the occupiable perimeter space by means of 800 operable windows or ceiling grilles, moves by means of pressure differential into the atrium and then vertically to exhaust fans below the skylight in the manner of a thermal chimney. Responding to physical, psychological, and physiological concerns for contact and comfort, the atrium serves as a unique social-environmental amalgam designed to enhance user experience.

Daylighting Enhancement Systems

Accomplished through a series of seven solar tracking heliostats that reflect light to a bank of fixed mirrors above the south side of the atrium, Genzyme's daylighting enhancement system recalls Foster's Hong Kong and Shanghai Bank and Behnisch's earlier LBBW and NORD/LB projects. Daylight reflected downward into the atrium to the ground level, activates garden and water surfaces that assist in the daylight's redistribution. Light Enhancement Systems supply 75% of the workspaces with 2 percent daylight and all workspaces have direct contact with the outside.⁴⁸ Workspaces at the periphery receive natural light through the fully glazed façade, 40 percent of which is double glazed and occupiable. Prismatic louvers that operate in relation to the sun's azimuth at the atrium roof regulate the amount of sunlight reflected into the space. Reflective balustrades join the 22 computer-controlled lamellar wall panels comprised of movable vertical louvers at the south side of the atrium to reflect the light, in the case of the lamellar wall panels, at different angles depending on their position. Controlling the amount of daylight admitted into adjacent spaces, the lamellar wall impacts one's perception of the atrium volume and surrounding spaces. Low-energy workplace task lighting grants people control of their environments and contributes to the reading of the building as a "congregation of individual places."⁴⁹

The Light Cloud

Stefan Behnisch compares this environmental light sculpture to "The beautiful appearance of sunlight in the morning, coming through the trees in the forest".⁵⁰ Comprised of 16 mobiles, made up of 768 acrylic one-foot square plates suspended by steel cables below the atrium skylight, this reflective chandelier assists light as it journeys to the building's lower floors.

Animating surrounding surfaces while reducing glare along its path, the light sculpture calls to mind Harry Bertoi's Kresge Chapel altar screen (1955) at MIT.

The Double Façade and Sun Protection

A 4-foot accessible void space or 'loggia' incorporated into 40% of Genzyme's façade responds to varying seasonal conditions. During summer, the double façade resists solar gain with ventilation removing excess heat from the façade cavity, while in winter solar gain warms the cavity reducing heat loss. Operable façade sun protection adapts to changing weather conditions that are continuously monitored by computer sensors. Simultaneously shading the interior (lower blind portion) while admitting diffuse light, (upper blind portion) the upper blind area reflects light up to 35 feet into the interior with assistance from metal-coated reflective ceiling tiles located near the blinds. Users can adjust the system to their liking, which after 30 minutes and near day's end, returns to a computer-controlled program. Atrium daylighting enhancement and façade systems produce a 45 percent reduction in energy consumption.⁵¹

Heating and Cooling

An innovative strategy that recycles steam from a nearby power plant approximately two blocks from Genzyme provides the energy for central heating and cooling. Recently upgraded to gas fired jet turbines, the power plant gained a new capability to distribute bi-product steam from one of its power generation cycles. Directly exchanged into heat for winter heating, during the summer steam drives absorption chillers for cooling. In addition to being one of the most efficient cooling methods, the local energy cycle suffers no distribution losses and enjoys a power plant economy of scale and aggressive emissions control. The energy-efficient heating and cooling features, employment of double façades, daylighting enhancement and sun protection systems and an extensive building management system, reduced the projected overall energy cost for the building by about 41%.⁵²

Storm Water Management and Water Conservation

Flowing into two collection tanks before being discharged into the storm water management system, storm water collected in the first tank supplements the water required for the evaporative cooling towers saving thousands of gallons of potable water annually. A second collection tank fed from skylight runoff waters the roof landscape when directed by computer-controlled sensors in the roof soil. This two-tank storm water management system lowers storm water runoff 25 percent while achieving significant potable water savings that, when considered with a 575,000 gallon reduction (32 percent below the LEED standard) in potable water use achieved by reduced flow fixtures, waterless urinals, and dual flush toilets substantially alleviates Genzyme's environmental impact.⁵³

Material Choices and Recycling⁵⁴

Material selection decisions at Genzyme considered the extent to which materials derived from renewable resources, contained recycled content, and exhibited low embodied energy during manufacture. Sustainable building material statistics distributed as follows:

1. 50% of building materials included recycled content.
2. 60% of building materials were manufactured locally (within 500 miles)
3. 20% of building materials were locally harvested
4. 80% of wood building materials were FSC (Forest Stewardship Council) certified

Indoor Air Quality

The design team avoided paints, sealants, adhesives that emit VOC's (Volatile Organic Compounds), composite woods that use formaldehyde, and carpets that produce chemical off gassing. Proactive strategies to enhance indoor air quality included natural ventilation, maximum air circulation, smoke free environments, and CO₂ level monitoring.

Building Structure: Filigree Floor Slab⁵⁵

Behnisch Architekten developed an innovative 'filigree floor slab' composite system of pre-stressed concrete planks. Varying depths of traditional cast-in-place concrete joined by welded wire trusses embedded on the inside combined with polystyrene void formers eliminated unnecessary concrete, resulting in a dramatic reduction in the slab weight.

Filigree System Advantages Included:

1. A 20% reduction in the amount of reinforcing steel
2. A 33% reduction in slab weight that reduced the overall deadweight of the building 25% that in turn dramatically lowered foundation weight
3. A filigree slab that served as the formwork for the top slab that eliminated 250,000 square feet of plywood formwork and 2604 sheets of three use 4x8 plywood
4. Efficient thermal storage and release of energy by the structural slab system
5. Local manufacture of this system reduced material embodied energy
6. Reduced volatile organic compounds that would have been used in 357 gallons of petroleum-based form sprays use to strip slab formwork

Sustainable Site Design Tactics⁵⁶

In addition to remediating its brownfield site, Genzyme utilized existing infrastructure whenever possible that included local energy sources. To its credit in an effort aimed at reducing single occupant gasoline powered auto use, Genzyme offered subsidized public transport passes, a guaranteed ride home/carpool database and subway access within ½ mile from the Genzyme building. Genzyme's investment in below grade parking and maximized open space site planning that exceeded city regulations by 50 percent eliminated asphalt albedo or 'heat island' effect. Automatic blinds and interior artificial lighting controls building ameliorated night time 'light pollution'. Then and now, careful initial construction staging practices and long-term commitment to roof gardens and a

comprehensive storm water management system minimized site disturbance and erosion.

Conclusion:

The significance and influence of Behnisch's environmentally humanist stance, as seen in the IBN, NORD/LB, and Genzyme case study projects cannot be underestimated. Many of the sustainable design achievements noted in the case studies have, in their origins, a respect for the individual within a carefully constructed democratic design framework. Sustainable design for Behnisch begins with a project's site, situation, prospect for the advancement of democratic ideals, careful social construction, and the architectural task. Despite their highly refined status, and cost in the case of NORD/LB and Genzyme, sustainable environmental technologies for Behnisch are not fetishized or seen as an 'end' but, are a means to realize the potential of Philip Regal's environmentally humanist ambition to establish a "pattern of connectedness among individuals and institutions and with the non-human environment"⁴ in support of a more environmentally conscious and humane world.

Endnotes

¹ Gauzin-Müller, Dominique. *Behnisch + Partners 50 Years of Architecture* Academy Editions: London, 1997. p 49.

² Behnisch, Behnisch + Partners, Eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 53.

³ *ibid.*, p 53.

⁴ Regal, Philip. "Ecohumanism: Refining the Concept" in *Humanism Today Volume 15* Prometheus Books: Amherst, 2002. p 62.

⁵ Gauzin-Müller, Dominique. *Sustainable Architecture and Urbanism* Birkhäuser: Basel, 2002. p 98.

⁶ *ibid.*, p 99.

⁷ *ibid.*, pp 100-101.

⁸ Kandzia, Christian. Lecture, *Behnisch & Partners: Aspects of our Work* delivered at Miami University, Oxford, Ohio, 25 Jan. 1995.

See here the context of the larger quote:

"We try to see the world in a differentiated way, to focus on diversity. This leads us to differentiate the

individual components of a building depending on their role. In the case of a steel girder the upper chord is subjected to compressive stress, the geometry is therefore different from that of the lower chord, which is subjected to tensile stress. And for us the mid span of a girder is different from its free end or the joint with another part of the building. We're dealing here with hierarchical orders-which occur whenever we view the world in a complex way."

⁹ I refer the use of the terms homotopia and heterotopia to the insightful Demetri Porphyrios article "The Ordering Sensibility of Heterotopia" featured in *Sources of Modern Eclecticism*, Demetri Porphyrios (London: Academy Editions. 1982), pp. 1-12 where he critically examines Aalto's classification and ordering sensibilities and the particular ordering strategies he employed to organize the building brief, plan, section, and what Porphyrios would refer to as the 'sensuous iconography' of his buildings. See page 2 for his explication of the terms homotopia and heterotopia.

¹⁰ Koster, Egbert. *Natuur onder architectuur: Architecture for nature* Schuyt & Co.: Haarlem, 1998. pp 66-67.

¹¹ *ibid.*, p 95.

¹² *ibid.*, p 63-66.

¹³ Behnisch, Stefan, Behnisch, Günter, and Günther Schaller. Trans. Ian Pepper. *Behnisch, Behnisch + Partner: Buildings and Projects* Birkhäuser: Basel, 2003. p 10.

For emphasis I include the entire quote:

"The task of architects must be to reinforce precisely those forces which cannot stand up for themselves, those failing to correspond to the social "mainstream." The cultivation of such forces is generally regarded as an optional exercise, not a duty. Hardly graspable in quantitative terms, they are quickly sacrificed in value engineering sessions. And yet it is just these "soft" aspects that constitute the rank and significance of a work of architecture."

¹⁴ The term *Halle* refers to an essentially aprogrammatic space that occurs in both Behnisch practices and was first employed in the mid-1950's educational projects of Günter Behnisch. It is typically a socially constructed public forum that intersects major program elements beginning on the ground floor that ascends vertically throughout the volume of the building. As a place for all building residents, employees, and staff to gather individually and in groups, the *Halle* provides a stage that enhances both the ritualized and general lives of the building occupants. Recently, in the work of Behnisch, Behnisch + Partner, building environmental systems synthetically integrate into, and enhance the Halle's spatial and social structure, activating the space in a profoundly original manner.

¹⁵ Gauzin-Müller, Dominique. *Sustainable Architecture and Urbanism* Birkhäuser: Basel, 2002. p 17.

This quote was also featured in

Metz, Tracy. "Behnisch, Behnisch + Partner let the environmentalists at IBN-DLO Institute in Holland practice what they preach." In *Architectural Record* Volume 188 no.1, 2000. p 97.

¹⁶ Behnisch, Stefan. Behnisch, Behnisch + Partner. Wells Century International Limited: Hong Kong, 2004. p VI.

¹⁷ The Senscity Paradise Universe, Las Vegas, (2004) is one of a series of innovative unbuilt competition projects that merge sustainable technologies with metaphorical allusion to landscape experience and biomorphic references aimed at promoting a relaxed atmosphere for social intercourse.

¹⁸ Koster, Egbert. *Natuur onder architectuur: Architecture for nature* Schuyt & Co.: Haarlem, 1998. p 158.

¹⁹ *Ibid.*, p 28.

The invited 1992 competition included Behnisch, Behnisch + Partner, (Germany) Otto Steidle (Germany) and Hans Ruijssenaars (The Netherlands).

²⁰ Koster, Egbert. *Natuur onder architectuur: Architecture for nature* Schuyt & Co.: Haarlem, 1998. p 14.

²¹ *ibid.*, p 11.

²² *ibid.*, p 7.

²³ *ibid.*, pp 58-56.

Behnisch prefers a "Humane Order" grounded in Humanism that prefigures his architecture literally and figuratively as 'open' structures, with an explicitly informal character. Design aesthetics and building technology take second place to the well being of the users. Avoiding representation as an expression of power or status, Behnisch's buildings do not have formal facades, symmetrical ground plans or hierarchical spatial organizations.

²⁴ Metz, Tracy. "Behnisch, Behnisch + Partner let the environmentalists at IBN-DLO Institute in Holland practice what they preach." In *Architectural Record* Volume 188 no.1, 2000. p 97.

²⁵ Gauzin-Müller, Dominique. *Sustainable Architecture and Urbanism* Birkhäuser: Basel, 2002. pp 13-14.

I refer here to Gauzin-Müller's enlightening and succinct account of the Rio Summit aims with particular emphasis on the Agenda 21's integrated approach that considers the social, economic, and cultural factors necessary to achieve a sustainable future through environmental conservation and a critical form of resource management.

²⁶ Koster, Egbert. *Natuur onder architectuur: Architecture for nature* Schuyt & Co.: Haarlem, 1998. p 33.

²⁷ Behnisch, Stefan. *Behnisch, Behnisch + Partner* Wells Century International Limited: Hong Kong, 2004. p 69.

²⁸ Blundell-Jones, Peter. "Forestry Commission" *The Architectural Review* Volume CCIX No. 1247, 2001. p 28.

²⁹ Koster, Egbert. *Natuur onder architectuur: Architecture for nature* Schuyt & Co.: Haarlem, 1998. p 33.

³⁰ Behnisch Arkitekten, *The Institute for Forestry and Nature Research IBN* Unpublished Design Competition Design Booklet Courtesy of the Behnisch Arkitekten Archives. Stuttgart, 1994.

³¹ *Ibid.*

³² *Ibid.*

³³ *Ibid.*

³⁴ *Ibid.*

³⁵ I make reference to Bruno Taut's use of the term 'Stadtkrone' and suggest that NORDLB, as a Late Modern 'Temple of Commerce', due to its socially conscious site planning and program, environmental responsibility, civic presence, and urban spatial qualities that can be envisaged as a contemporary derivative of Taut's original use of the term. Kenneth Frampton describes 'Stadtkrone' as "that pyramidal form postulated by Taut as "the universal paradigm of all religious building, which together with the faith it would inspire was an essential element for the restructuring of society" as described in:

Frampton, Kenneth. *Modern Architecture: A Critical History* Thames and Hudson: London, 1992. p 116.

³⁶ Metz, Tracy. "Behnisch, Behnisch and Partner creates a glimmering, dynamic, and energy efficient-landmark in glass and steel at the Norddeutsche Landesbank" *Architectural Record* Volume 191 No. 2., 2003. p 125.

³⁷ Behnisch, Stefan. *Behnisch, Behnisch + Partner* Wells Century International Limited: Hong Kong, 2004. p 167.

³⁸ Flamme-Jasper, Martina and Sandra Harper Trans. *NORD/LB Hannover: Behnisch, Behnisch & Partner*

Hatje-Cantz: Ostfildern-Ruit, 2002. p. 98.

³⁹ Ibid., pp 98-104.

⁴⁰ Ibid., pp 99-100.

⁴¹ Ibid., pp 57-59.

A particular account of the tower façade can be found in:

Behnisch, Stefan. and Gunter Schaller. Trans. Pepper, Ian and Robin Benson, *Behnisch, Behnisch + Partner: Buildings and Designs* Birkhauser: Basel, 2003. p 220.

⁴² Ibid., p 105.

⁴³ Steele, James and Behnisch, Behnisch + Partner, eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 5.

I include here for emphasis Michael Sorkin's full quote that explores Behnisch's use of non-hierarchical space and positions the garden as a social agent:

"Behnisch, Behnisch + Partner adds both a crucial overlay of green and promotes social life by eliminating the stifling prejudice of the vertical. The architects use their spatial distributor brilliantly to organize light, air, sociability, circulation."

⁴⁴ Steele, James and Behnisch, Behnisch + Partner, eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 5.

⁴⁵ Ibid., p 8.

⁴⁶ Ibid., p 5.

For further clarity, see Sorkin's following statement to the aforementioned citation:

"Modeled on our own respiratory cycle, on our physical and psychological need for comfort and contact, Genzyme is a masterpiece of common sense, commonweal, and uncommon beauty."

⁴⁷ Behnisch, Stefan. *Behnisch, Behnisch + Partner* Wells Century International Limited: Hong Kong, 2004. p 245.

Reference also found in:

Behnisch, Stefan. and Gunter Schaller. Trans. Pepper, Ian and Robin Benson, *Behnisch, Behnisch + Partner: Buildings and Designs* Birkhauser: Basel, 2003. p 152.

For further elaboration, an expanded reference is included here:

"The result is a climate oasis extending over all twelve levels, spreading like a tree with its limbs and branches. It develops from the center of the building through to the facades, creating distinct spatial arrangements throughout the atrium with different private and public atmospheres."

⁴⁸ Steele, James and Behnisch, Behnisch + Partner, eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 56.

⁴⁹ Davey, Peter. "Luminous Paradigm: The Genzyme Center brings transforming imagination to US office design, adding environmental and human dimensions" *Architecture Review* April, 2004. p 60.

⁵⁰ Steele, James and Behnisch, Behnisch + Partner, eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 47.

⁵¹ Ibid., p 77.

⁵² For a description of this unique heating and cooling strategy please see:

Behnisch, Stefan. and Gunter Schaller. Trans. Pepper, Ian and Robin Benson, *Behnisch, Behnisch + Partner: Buildings and Designs* Birkhauser: Basel, 2003. p 61.

The Projected 41% Energy Savings statistic was garnered from the Energy section of the Genzyme Entry on The AIA Committee on the Environment Website *aiatopten.org* under the 2004 COTE Top Ten green projects from 2004.

⁵³ Steele, James and Behnisch, Behnisch + Partner, eds. *Genzyme Center* FMO Publishers: Stuttgart, 2004. p 76.

⁵⁴ Ibid., pp 76-78.

⁵⁵ Ibid., pp 35-36.

⁵⁶ Ibid., p 76.

Illustration Credits:

¹ Fig. 1. Genzyme Center Atrium:
Courtesy of Behnisch Arkitekten Archives, Stuttgart

² Fig. 2. IBN Interior Courtyard
Courtesy of Behnisch Arkitekten Archives, Stuttgart

³ Fig. 3. IBN South Facade
Courtesy of Behnisch Arkitekten Archives, Stuttgart

⁴ Fig. 4. NORD/LB Interior Courtyard
Courtesy of Behnisch Arkitekten Archives, Stuttgart

⁴ Fig. 5. NORD/LB Exterior View
Courtesy of Behnisch Arkitekten Archives, Stuttgart