BALANCE

TANGRAM
april 2011

BALANCE

DIMENSIONS OF SUSTAINABILITY

Sustainability is a concept that is used both appropriately and inappropriately. It is indeed an ambiguous concept. It is misused and typically evokes a hype used to lend legitimacy to a product/building. Sustainability need not necessarily have to do with 'green' or 'nature' and has more meanings than just 'energy-efficient' or 'CO2 neutral'; it can also transcend such aspects, something which certainly applies to the sustainability of buildings.

The sustainability of buildings is today measured incorrectly: the most energy-efficient CO2 neutral building can score very poorly on the sustainability ladder if it is standing at the wrong location.

The spatial component, missing from today's measurement methods, ultimately determines the actual sustainability scores of buildings and the built-up environment.

BALANCE presents old and new dimensions of sustainability in the construction field. This goes beyond just a critical survey of the development of the concept, sustainability in different phases and conceptions – it represents an attempt further to advance the concept itself.

TANGRAM
architecture and urban landscape

NATURE

SUSTAINABILITY

ECOLOGY

SUSTAINABILITY

ENVIRONMENTALLY FRIENDLY MATERIAL

THE DIMENSIONS

TECHNIQUE

SUSTAINABILITY

LIFETIME

SUSTAINABILITY

SAVING ENERGY

1 OF SUSTAINABILITY

ensluidend] *afschrift*);
ce'ren, –ceerde, h. ge-
uplicare: *een repliek*

. duplique: *beantwoor-*
): *na re'- en du'pliek.*
tweevoud): *iets in – af-*
i), in twee exemplaren.
ieur): *de –toonladder,*
. *doer.*
rable [Lat. durabilis]:
olkst. *duur*).
at.) = De wet is hard,
wet.
zeer harde aluminium-
iegtuigbouw).
(*een voortdurende han-*
slapen is een – werk-
en (*een duratief ww.*).
erzisch-Hindoes: eig.
ndië: 1 *morgenaudiën-*
rsten; 2 *galareceptie*;

eduurd (1 *blijven be-*
anhouden; 2 *goed blij-*
het zal mijn tijd wel
ng als ik leef; zegsw.
n) *is een schone stad,*
ging: *maar blijven is*
et blijft zelden lang
t mij niet lang meer –,
meer uithouden, zal
de reis duurt 5 uur;
– dit jaar.
gaastuk): 1 *er zit – in*

alles duur is; *dure mensen*, ir.: rijke en chique; *logeren in een – hotel*, waar alles duur is; fig. *goede raad was –*, niet te vinden; *zijn leven – verkopen*, zich tot het uiterste verdedigen; *iets – moeten betalen*, fig. zwaar boeten voor; zie vis; *een dure eed zweren*; *een dure plicht*, bindend.

duur'koop, bn. (*duur om te kopen*): zegsw. *goedkoop –*, wat goedkoop is gaat niet lang mee; ook: *– goedkoop*, wat duur scheen blijkt later door de duurzaamheid goedkoop.

duur'te, v. (*het hoog in prijs zijn*): *– van levensmiddelen*; **–bijslag, –toeslag,** m. –en (*toeslag op het loon* wegens duurte der levensbehoeften); z. toeslag.

duur'zaam, 1 bn.; duurzamer, –st (1 *lang durend*; 2 *weinig aan slijtage of bederf onderhevig*; 3 *langdurig en veelvuldig*): 1 *een duurzame vrede*; 2 *eikehout is –*; 3 *bevestigd door – gebruik*; **2** bw. (*voor lange tijd*): *de vijand – het hoofd bieden*; **–heid,** v.

du'vel, m. –s (1 gmz. *duivel*; 2 ruw: *lichaam*; 3 *bijdehand kind*): 2 *op zijn – krijgen, geven*, een afstraffing; 3 *'t is toch zo'n –!*; **–tje,** o. –s (1 *kacheltje met kookplaten*; 2 *bijdehandje*); **du'velen,** duvelde, h. geduveld (gmz. 1 *razen en tieren*; 2 *vallen*): 1 *altijd – en donderjagen!* 2 *hij is van de trap geduveld*; ook: *iem. de deur, het huis enz. uit –*, zetten, gooien; **du'vels,** bn. (*boos*); bw. (*heel erg*): *– worden*; *– hard rijden*; **duvels-toe'jager,** m. –s (gebruikelijke vorm voor *duivelstoejager*: *iem. die voor allerlei ongeregelde werkzaamheden wordt gebruikt*)

8

1.1 EVOLUTION OF A TERM

If there is one concept that is constantly used and misused today, it is the concept of 'sustainability'.
Today everything is labeled sustainable – from political decisions to Christmas presents.
To many people, however, sustainability is primarily associated with the **use of nature-friendly** materials. And even then there is often a lot of disagreement about exactly which materials and which aspects are taken into consideration to justify that title.
Does it concern production or does it concern use?
Are process and decomposition taken into consideration?
How much energy do we need to enable us to process a material?
Are the transport of raw materials and finished products also considered?

Durability as a criterion

Over the years the concept has developed enormously.
In the Koenen dictionary published 30 years ago we find the word sustainable defined as **'not susceptible to wastage or deterioration'**.[1]

$$\text{sustainability Koenen 1966} \sim \frac{1}{\text{wastage}}$$

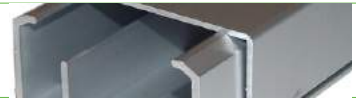
Koenen woordenboek der Nederlandse taal, 1966
The term "sustainable" is defined in this dictionary as "1 long term; 2 not susceptible to wastage or deterioration; 3 enduring and frequent"

Time was the all-determining factor. In the construction industry a material like wood was therefore deemed to be 'not sustainable' ('wood means maintenance'). Concrete, steel and aluminum: they were sustainable.

the concept of sustainability is appropriately an inappropriately used in advertising


albusgolf
Play golf and feed fish with ECOBIOBALL


NBD-online is zoeken, vinden en vergelijken
NBD TV
Veelgestelde vragen
Contact
Nieuws
Home ▸ Zoeken ▸ Product
< Terug naar zoekresultaten
< Opnieuw zoeken
Productcategorie
NBD
Installatie
Constructies en ma...
Gevels
Binnenwanden/plafonds
Vloeren en trappen
Daken
Ramen en deuren
Transport
Inrichting
W-installaties
E-installaties
Buitenruimte
EUROWALL® thermisch isolerende PUR-hardschuim geschikt voor duurzaam bouwen
▸Vergelijken in mijn NBD
▸Informatie aanvragen
▸Afdrukken
▸Doorsturen
Eurowall® thermisch isolerende PUR-hardschuimplaten geschikt voor toepassing in spouwmuurconstructies met behoud van luchtspouw conform de eisen van het Bouwbesluit. Eurowall® is een polyurethaanschuim met een gesloten celstructuur en kenmerkt zich door het uitstekende isolerende vermogen (...
Recticel Insulation Nederland
Spoorstraat 69
4041 CL Kesteren
Tel: 0488 489400
Fax: 0488 493187
E-mail: insulation_info@recticel.com
Website: www.recticelinsulation.nl
Mijn NBD
Als u zich aanmeldt, blijft uw selectie bewaard tot een volgend bezoek
▸Inloggen
▸Registreren
NBD kennistools
Bouwdetails
Bouwgebreken
Bouwkosten
Bouwtechniek
E-installaties
W-installaties
Installatiekosten

ASSESSMENT CRITERIA durability	MATERIAL	ASSESSMENT CRITERIA durability depletion of earth production process
BRICK long lasting, few maintenance ✓		**BRICK** long lasting, few maintenance ✓
WOOD (NETHERLANDS) limited durability; regular maintenance ✗		**WOOD (NETHERLANDS)** limited durability; regular maintenance; sustainable production process of raw material ✓
HARDWOOD (BRAZIL) long lasting, few maintenance ✓		**HARDWOOD (BRAZIL)** long lasting, few maintenance, long transport route, poor working conditions, (illegal) logging threatens rainforest ✗
CONCRETE long lasting, few maintenance ✓		**CONCRETE** long lasting, few maintenance, raw materials are finite, recycling ✓
ALUMINIUM long lasting, few maintenance ✓		**ALUMINIUM** long lasting, low maintenance, recyclable, energy-intensive production, finiteness of raw material bauxite ✗
STEEL long lasting; regular maintenance ✓		**STEEL** long lasting; regular maintenance ✓
NATURAL STONE (CHINA) long lasting, few maintenance ✓		**NATURAL STONE (CHINA)** long lasting, low maintenance, long transport route, poor working conditions quarries ✗
NATURAL STONE (EUROPE) long lasting, few maintenance ✓		**NATURAL STONE (EUROPE)** long lasting, few maintenance ✓
PLASTIC long lasting, few maintenance ✓		**PLASTIC** long lasting, few maintenance; poor recycling options ✗

Material, production and Mother Earth

Current definitions differ significantly.

Wikipedia, the popular site for definitions, notes for sustainability:

Sustainable (duration) – for a long time; of a product: that lasts long.

Sustainable (development) – of a process: that can be applied permanently because it doesn't deplete the earth; of a product: made using a method of production that is sustainable in this sense.[2] This revision throws another light on the various materials. A natural product like wood is therefore considered to be very sustainable; steel, concrete, aluminum are suddenly viewed very differently.

$$\text{sustainability wikipedia 2010} \sim \frac{\text{lifespan of product}}{\text{extent of depletion of earth}}$$

left column assessment of materials based on definition Koenen 1966

right column assessment of materials based on definition wikipedia 2010

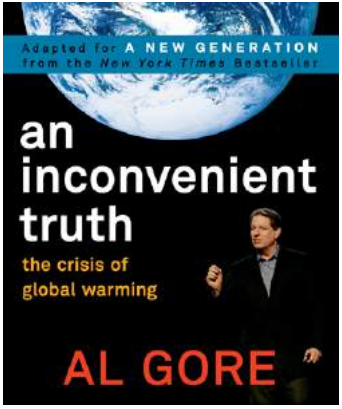

material
material
material
material
material
sustainability
1
material
environment
energy

MATERIAL

FIRST DIMENSION OF SUSTAINABILITY

Sustainability starts as a simple, one-dimensional concept. The meaning does not change for a long time, durability is considered the main aspect. Very slowly one begins to realize that depletion of the earth is an important aspect.

In the 1960s the Club of Rome[3], with its report 'The Limits of Growth', was the first authoritative organization that not only expressly drew attention to the concept of sustainability, but also placed it in a much broader context. Far ahead of its time, this group introduced a new way of thinking on another level; it went much further than the use of material and involved all human activity in its understanding of sustainability.[4]



AN INCONVENIENT TRUTH
In 2006, Al Gore – 'the best president the US never had,' succeeded in shaking up the world with his plea in film form for a different, more conscious approach to the finiteness of the natural possibilities of our planet. He was awarded the Nobel Peace Prize for his efforts.

Gore also wrote a book which attained less notoriety: 'Our Choice. A Plan to Solve the Climate Crisis' (2009).

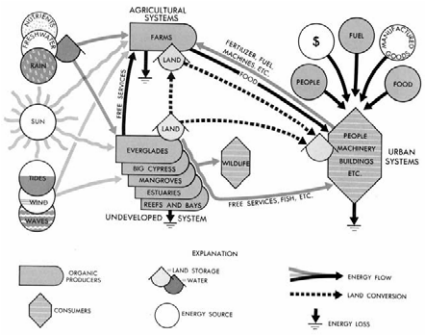


diagram from "The Limits to growth: a global challenge", Club of Rome, 1972

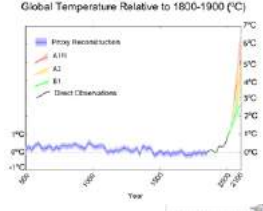


Figure 21: Reconstructed, observed and future warming projections

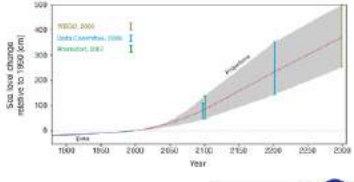


Figure 17: Past and future sea-level projections

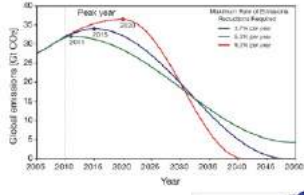


Figure 22: Emissions pathways to give 67% chance of limiting global warming to 2°C

1.2 A HOLISTIC VISION: A BIG STEP FORWARD

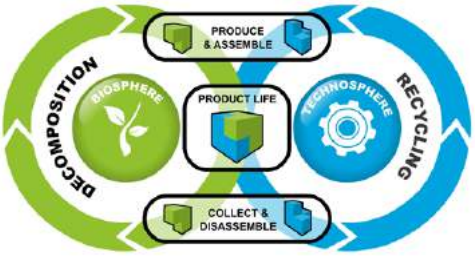
We haven't learned all that much from the ideas of the **Club of Rome**: in the years that followed, **economy weighed more heavily than ecology** – until the world entered a global economic crisis. It is no accident that this coincides with an ecological crisis.
Within a relatively short space of time, it is at last becoming clear across society that the economy can only flourish in the long term if it does not occur at the expense of the earth and its resources but, rather, can exist in **balance** with it. The holistic vision of sustainability has made its entrance.

Global climate change

Recent studies have revealed the finite character of our planet: the burning of fossil fuels generates a huge excess of carbon dioxide in the atmosphere, heats up the earth, melts the polar caps and glaciers, and raises sea levels. Climate zones shift: the Netherlands is becoming a wine-growing region and southern France a desert. Unless we take adequate measures, parts of the country will be flooded: Amersfoort will end up on the coast. Only **rigorous changes** from the use of **fossil energy** to the application of solar energy, wind energy, and tidal energy can alter this situation to some degree.

Cradle to cradle

An exponent of the way of working is the widely acclaimed Cradle to Cradle theory – sustainability as described by the physicist Braungart and the architect McDonough.[5]
To them, sustainability of material means **'non-biodegradable for the duration of the intended lifespan'** – but not longer than that. Material must be able to be assimilated back into nature – in the



'CRADLE TO CRADLE: Remaking the Way we Make Things,' M. Braungart and W. McDonough (2002)

High-quality use and circulation of organic and synthetic materials: biosphere and technosphere; waste = food

1 cherish diversity

2 connect place and context

3 combine city and nature

4 anticipate change

5 keep innovating

6 design healthy systems

7 people make the city

'THE SEVEN ALMERE PRINCIPLES' (2008) [6]

Almere was the first Dutch municipality to give central importance to the C2C principles in its policies

THE PASSIVE HOUSE

Up to 2010, only a few isolated projects have been inspired by the C2C principles

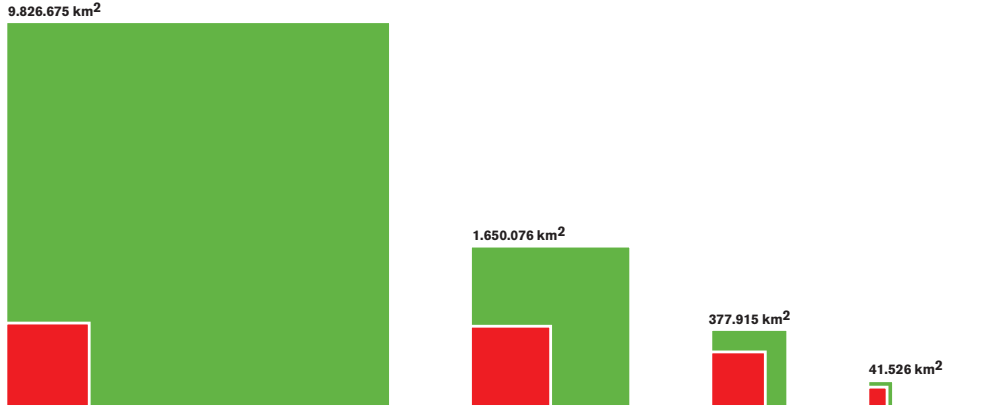
sense that it should in fact be 'biodegradable', although in a controlled manner.
In this vision, the entire genesis and life cycle of a material is of importance, as is the impact on man and culture; and so too therefore are the raw materials and the way in which they are obtained, and the question of whether they are in harmony with or come from the place of use.

$$\text{sustainability C2C} \sim \frac{\text{lifespan of material x residual value x sociocultural value}}{\text{fossil energy consumption x depletion of new raw materials from earth}}$$

This vision therefore goes much further than material, product, and process. Cultural and local influences are taken into consideration: what is available nearby requires less energy to process. What suits the culture will endure, while what deviates from it will do so less. Human actions and consent are taken into consideration.

The authors distinguish between the biosphere (everything that is fully biodegradable) and the technosphere (everything else made by man). **Waste matter is turned into food again and vice versa**. What cannot decay must be reused as lasting building blocks for future products. The extraction of raw materials should be kept to the very minimum. Energy — as little of it as possible in any case — should no longer be extracted from finite fossil fuels. There are enough alternatives such as solar energy, wind energy and tidal energy.

Available land area in relation to size of population



Geopolitical factors

Availability within a short distance is an important factor in the use of energy and materials. Geopolitical factors play an important role. The United States, the country of the authors, enjoy an advantage in this regard owing to its combination of different climate zones, great mineral resources, and a relatively undeveloped countryside with huge stocks of natural supplies that enable the country to be relatively self-sufficient in meeting its own requirements.

Compare that with the Netherlands: small and full as it is, it is impossible. The Netherlands, for example, uses eight times more wood than it can produce.[7]

Luckily, the country is part of the new European Union. But even then it falls far short in comparison with the United States. Europeans will have to think very carefully about how to supply their own countries. Shipping tons of stone from China or timber from Indonesia is certainly not the right way.

$$\text{sustainability C2C} \sim \frac{\text{lifespan x reuse x sociocultural factors x spatial quality}}{\text{energy consumption x use of space}}$$


material
process
1
2
sustainability
material
environment
energy
sustainability
economy
ecology
sociology
(cultural) history
demography

PROCESS

SECOND DIMENSION OF SUSTAINABILITY

This holistic vision of C2C is undeniably a big step forward. But is it really all? Will we achieve the ultimate sustainability in construction if we just observe these rules? Are the 7 principles the ticket to heaven?

SCARCITY OF SPACE

Problems pile up. Not only is there an excess of carbon dioxide. Not only are fossil fuels and products nearing exhaustion. Population increase and increasing use of space per person are leading to a scarcity of space. The 'culture of greed' has not been limited to the economy. Here too we see the finite character of the earth and its resources. All existing definitions of the sustainable handling of resources ignore this aspect.

In short: there's a missing link.

LIMITED VISION

Although the principles of Cradle to Cradle go further than many other definitions of sustainability, they don't go far enough. In C2C, the authors Braungart and McDonough make the step from the industrial semimanufactured product to the dimensions and complexity of the building.
Zero carbon, recycling materials, quality of light and air for the user … the story is almost finished. But a building cannot be judged or assessed in such a way according to sustainability. What is still lacking is a direct link with the surrounding spatial order, the historical context, and the cultural dimension. It is precisely these that determine the appreciation and assimilation of the chosen solution, and therefore its permanence too.
In fact, this is why every debate about sustainability in construction falls well short. As a consequence, existing measuring instruments for the sustainability of buildings do not count them as important criteria.

Every form of construction must start with careful consideration of where one can and may build; in fact, a building can only be sustainable if it is built on the right spot.
And conversely: a structure built on the wrong site can perhaps appear very sustainable, but it will not enjoy a long life. So the question is: where is building good and where is it not good?

street in new housing area, 'VINEX-wijk' Weidevenne, Purmerend

DISCUSSION: VINEX[8]

The current discussions about the VINEX neighborhoods are a telling illustration. There are increasing doubts about whether these additions to the periphery of existing cities were so sensible. They are not held in high esteem, amenities are lacking, and connections to the neighboring city are often insufficient. At the same time a middle-class group, important to the city's viability, is tempted out of the city – with disastrous consequences for the city itself. Perhaps we have been building in the wrong place for decades – in an incorrect urban and architectural typology. If this view gains currency, then these neighborhoods will seem not sustainable owing to a lack of appreciation. Likewise, a high-quality building according to the principles of Cradle to Cradle, located in a similar 'wrong' place, will probably be written off in the short term for the same reason. A sustainable building in a non-sustainable environment will not enjoy a long lifespan in the end. And it isn't just planning considerations that are important; the nature and quality of the urban fabric is also important. Only if the direct public environment of a building is of good quality will a building have an opportunity to show its most sustainable side. Ask a Dutch person what is his or her favorite building, and nine times out of ten they will say a building in a historical or natural context. That these buildings are appreciated as being sustainable does not specifically have to do with their sustainable development and construction but much more with the fact that the spatial situation is evidently a match for the permanent 'pressure of use' and has succeeded in absorbing every form of change. It is often the case that it is not so much the appreciation of the building itself that determines its sustainability but the total context in which the building is set – i.e. building and surroundings together. Moreover, it is not only about structure but also about culture. A good spatial constellation means that there will be sufficient resistance to the ravages of time. Careful integration, whether in an urban or rural context, makes people appreciate a building and, if necessary, makes them renovate or restore it.

Sustainability, therefore, is not connected exclusively with such principles as those of Cradle to Cradle but much more so with developments in spatial organization. Current insights tell us that we make major mistakes when we take administrative, economic and political decisions.

Sustainability in construction goes beyond the measuring of lifespan, consumption, and reuse of material and energy. Sociocultural implications and the organization of (public) space give a new dimension. A good balance between all factors leads to genuine sustainability.


DEMOLITION
RE-USE
NIGHT VENTILATION
LIVING ENVIRONMENT
SUSTAINABILITY
GREY WATER
USAGE TIME
FLEXIBILITY
ENERGY
RAINWATER
SUSTAINABILITY
SPACE
TRANSPORT ENERGY
ECOLOGY
AESTHETICS
GEOTHERMAL HEAT STORAGE
SUSTAINABILITY AND
ENERGY PRODUCTION
COMPACTNESS
SITE-SPECIFIC
LIFESPAN
ENERGY PERFORMANCE
SUSTAINABILITY
GREEN SURFACE
MAINTENANCE
GEOTHERMAL COLD STORAGE
NETWORK
TIME
SUSTAINABILITY
DOWNCYCLING
MATERIAL
RECYCLING
UPCYCLING

2

SPATIAL ORGANIZATION

2.1 THE NEW DIMENSION IN SUSTAINABILITY

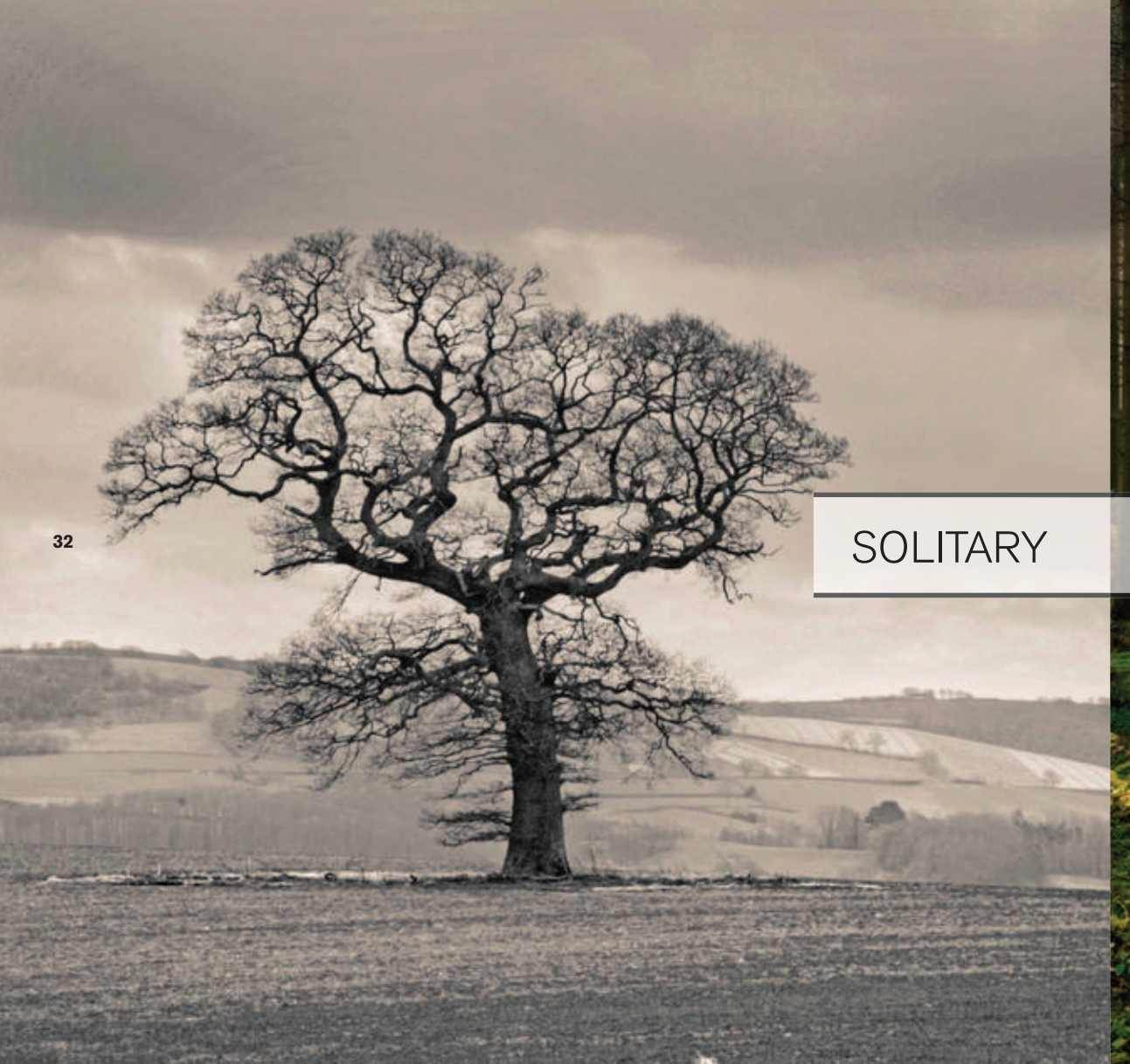
Scarcity of space is the next big problem that we must take into account when considering sustainability.
A **balance** is needed between built and unbuilt. Undeveloped land is vital for the green buffers that provide for our oxygen and the breakdown of carbon dioxide, for the cultivation of crops and timber for construction, and certainly for our mental wellbeing. Certainly in a full country like the Netherlands, the ratio of developed to undeveloped seems askew.

That is why the **qualitative** assessment of buildings and open space, and the **interaction** between the built and **unbuilt environment** is vital in our assessment of the sustainability performance of the built surroundings. Everything calls for compact development: for a building outside the city, scarce land is sacrificed, the energy demand per square meter rises, and more infrastructure must be built.
That gives rise to additional costs, energy consumption, and material consumption. In that sense, **sustainability** in construction is **in proportion to compactness**. A building in the city is better protected against the elements than a freestanding building elsewhere, and that saves energy. Moreover, an ensemble of buildings makes possible a combination of functions such as housing and amenities that can result in space savings. The ensemble achieves more with less, as is often the case in nature. Those are the hard facts of ecology and economics, but we must also **want to do this**.

Concentration

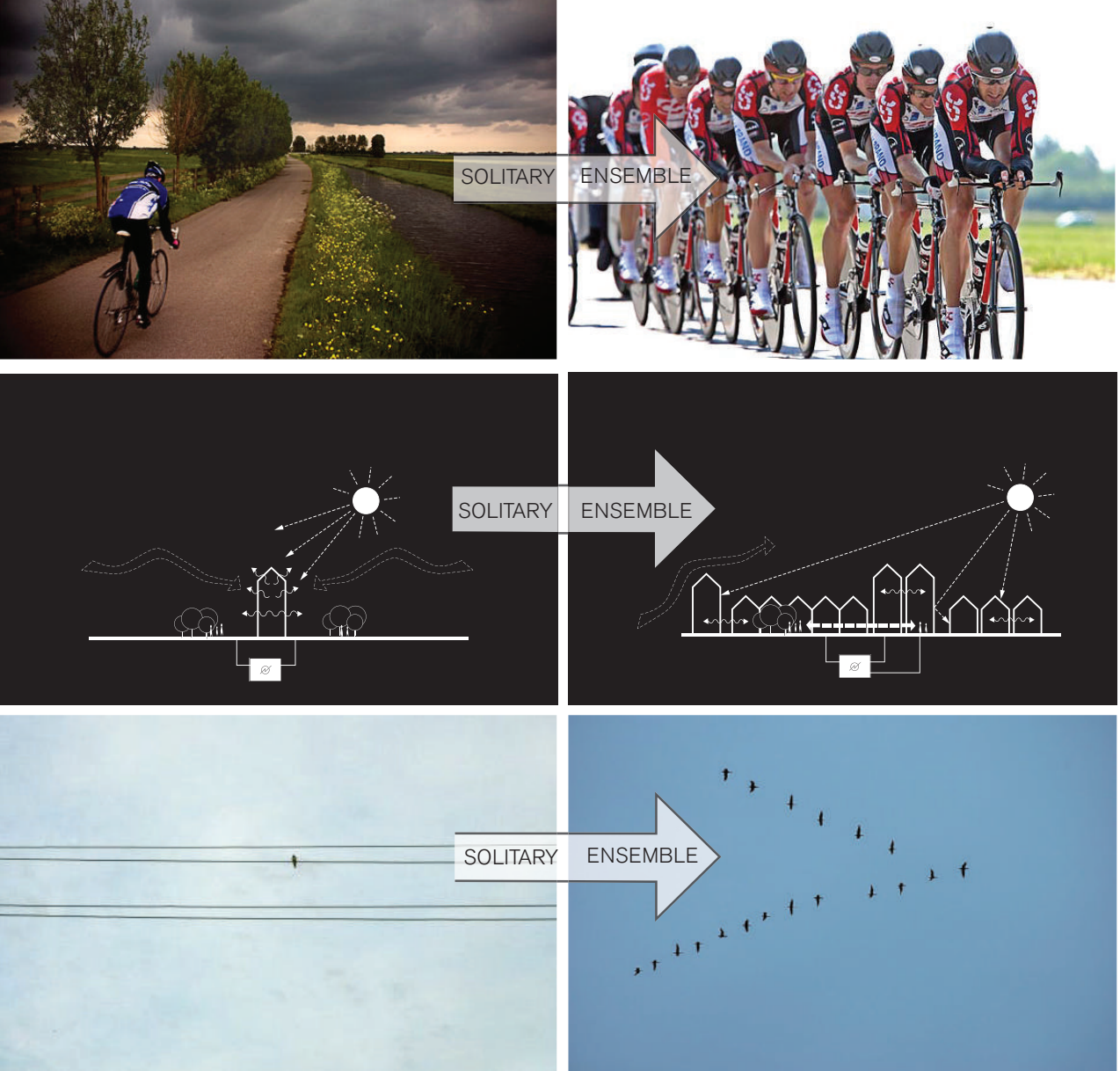
The **reduction of energy consumption** in buildings is high on the political agenda. This is an important factor when we are dealing with

nature and open spaces
The use of new land is an irreversible action and has a substantial effect on adjacent open land



SOLITARY

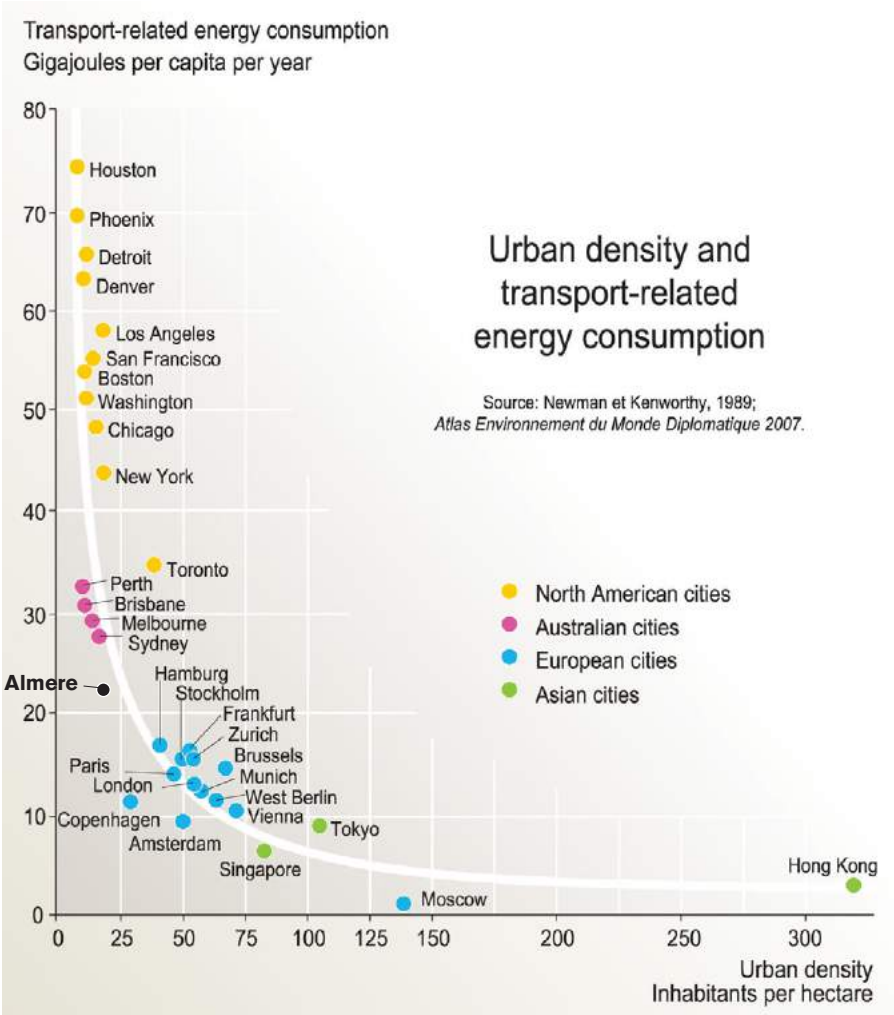

ENSEMBLE


SOLITARY
ENSEMBLE
SOLITARY
ENSEMBLE
SOLITARY
ENSEMBLE

the reduction of the use of natural raw materials and the reduction of carbon dioxide emissions. This is a familiar subject for politicians and directors.
Strangely enough, however, the impact of the spatial organization of an area on the energy consumption of buildings is not a subject of discussion, even though the examples abound in nature.
There exists a clear relationship between the 'ecological footprint' of a building and the density of the urban fabric in which it is located. View the building as part of the organism of the built spatial surroundings and it will become clear that we can make great savings in energy consumption when it comes to space.

Every building will be able to contribute to careful energy consumption. It is, however, more interesting if the buildings can 'communicate' with one another and work together to achieve a better result. A building placed in open space results in an unlimited exposure to the elements. No matter how compact a building is made, the cooling and heating through natural processes outside will be a maximum. Conversely, buildings that are grouped carefully will be able to produce better energy performances if they are treated as a group. Think of the migration of birds or the effect of a peloton of cyclists and it becomes clear that there is much to be gained from the careful, concentrated grouping of buildings. From the point of view of energy, therefore, **concentration and compactness** are therefore of great importance.
Particularly in areas where wind is an important natural factor, increasing the density of the built surroundings plays an important role.
In addition, exposure to the sun is a factor to be taken into consideration. The concentration of buildings should be arranged in such a way as

learning from nature
ensembles are better: more protection, less energy loss, shorter distances, opportunities for common energy solutions without large investments


Transport-related energy consumption
Gigajoules per capita per year
80
70
60
50
40
30
20
10
0
Houston
Phoenix
Detroit
Denver
Los Angeles
San Francisco
Boston
Washington
Chicago
New York
Toronto
Perth
Brisbane
Melbourne
Sydney
Almere
Hamburg
Stockholm
Frankfurt
Zurich
Brussels
Paris
Munich
London
West Berlin
Vienna
Copenhagen
Amsterdam
Tokyo
Singapore
Moscow
Hong Kong
0
25
50
75
100
125
150
200
250
300
Urban density
Inhabitants per hectare
Urban density and transport-related energy consumption
Source: Newman et Kenworthy, 1989;
Atlas Environnement du Monde Diplomatique 2007.
North American cities
Australian cities
European cities
Asian cities

to create enough shadow yet also to guarantee maximum exposure to sunshine. Intelligent plot patterns can offer a solution here. The design of individual buildings can also help. Familiar elements are open facades and sun lounges, and solar panels on the roof.

Shared energy supply

A concentration of buildings creates the possibility to share energy supplies. We are familiar with heat-storage systems in the ground and heat cogeneration.

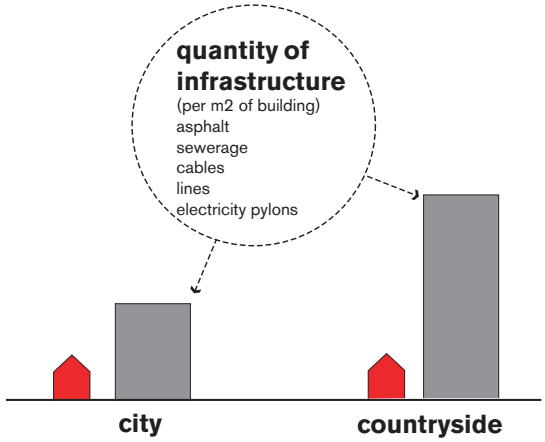
Moreover, shared wind turbines as well as water and waste processors benefit from a more intensified organization of buildings. These amenities should no longer be considered as 'luxury' amenities but, rather, be incorporated as standard conditions in a building's design.

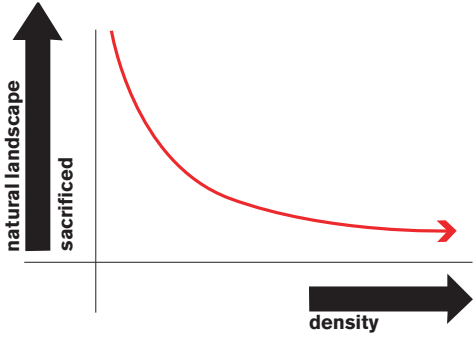
Sustainable spatial organization

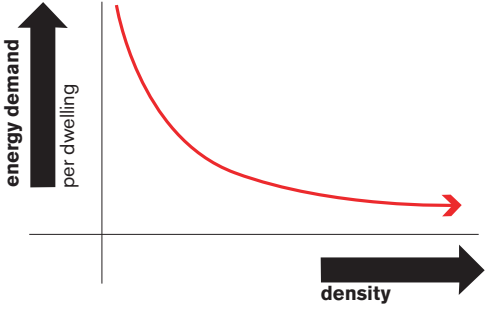
A concentration of buildings in more compact settings will improve not only the energy performance of each building but also the energy performance of an entire area and result in the reduced use of materials. Concentration and density of buildings means fewer lines of transport and better possibilities to establish networks for energy and communications. As early as 1989, Kenworthy and Newman had demonstrated the relation between density and transport-related energy consumption.[9] Their conclusion, not surprisingly, is: the higher the density, the better. A 'new' city like Almere scores very badly in this overview with just 20 inhabitants per hectare.

The more isolated a building is located, the more of everything that is needed: more infrastructure, more technology networks, and more sewer system. Careful consideration of a building's sustainability therefore demands a study not only of the material and energy consumption within the building but also the use of materials for the

transport energy
Newman & Kenworthy, 1989: Transport-related energy consumption as compared to the density of the city. Sprawl scores poorly – the intense city, well. Note the position of C2C-town Almere


quantity of
infrastructure
(per m2 of building)
asphalt
sewerage
cables
lines
electricity pylons
city
countryside


natural landscape
sacrificed
density


energy demand
per dwelling
density

necessary connections of all such networks.
It is therefore time for a generally accepted, broader approach to performance levels in relation to sustainability:
Buildings in a more compact setting will, by definition, score better than those in 'less concentrated' surroundings. These is therefore much to be gained from increasing spatial density.

$$\text{sustainability} \sim \frac{1}{\text{traffic movements}}$$

Nature, open space and countryside

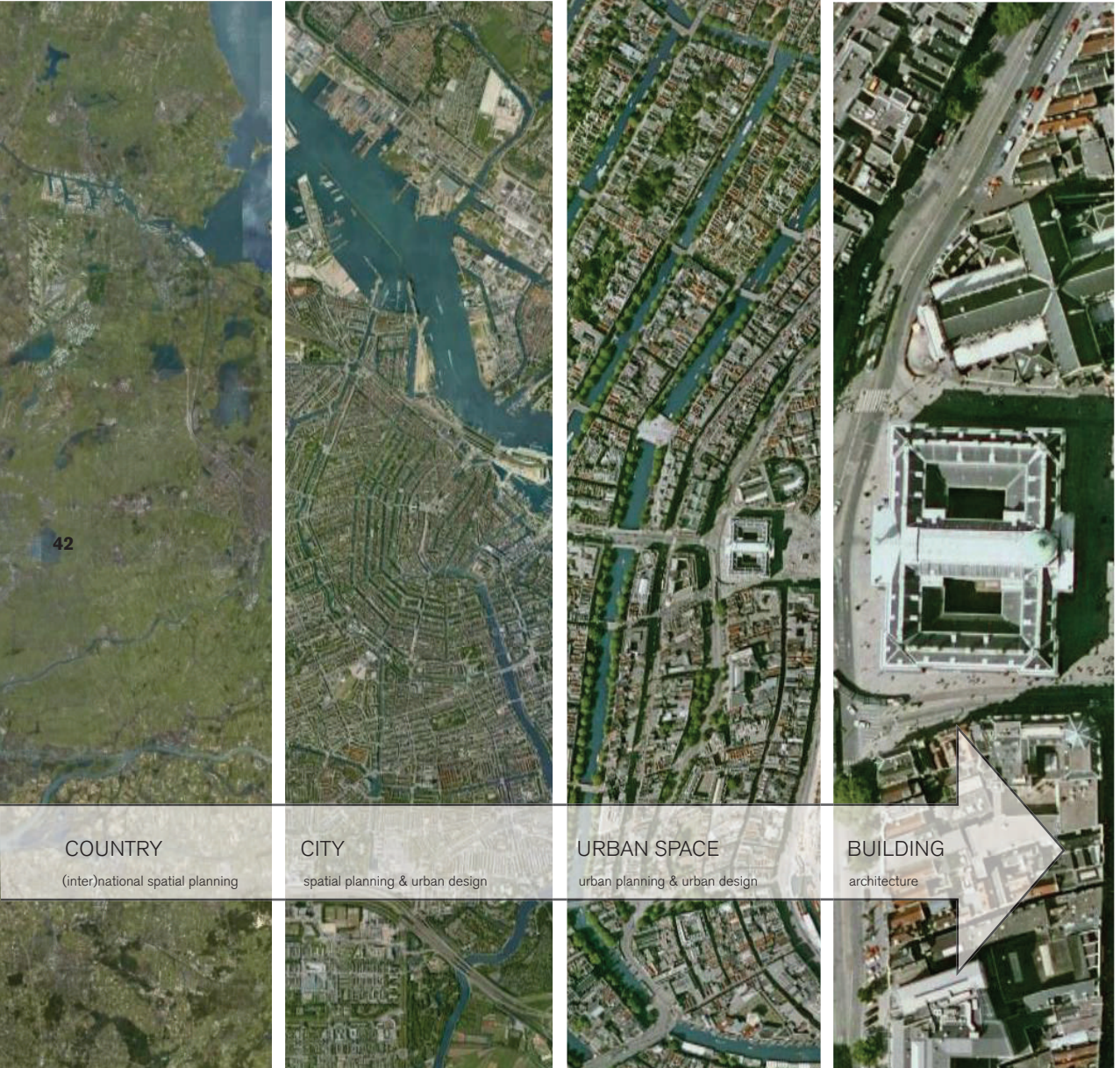
The construction of new buildings, no matter how sustainable, means the use of space.
Depending on the extent of increasing the density of this construction, this means the use of more or less land and space.
Moreover, in a sustainable approach to building design, open (public) space is used and in relation to the space and nature policy much can be gained from a more compact arrangement.
Every open space that is developed will never become undeveloped again. This process of using space is practically irreversible. If the Netherlands wants to implement a sustainable policy in the field of spatial planning, then the careful use of space should be a key consideration. The sustainability of a building could therefore be measured according to the extent of the use of 'new' construction land or the impact on open space.

Sustainability performance of a building is tied to the density of a plan and the surrounding area.

ecological footprint
Density has great impact on the ecological footprint of buildings


ABN AMRO

It is not the individual building that **defines sustainability**, but rather, **the ensemble of buildings** as it relates to the adjoining **public space**.



COUNTRY

(inter)national spatial planning

CITY

spatial planning & urban design

URBAN SPACE

urban planning & urban design

BUILDING

architecture

Sustainable buildings or sustainable use of space

To achieve genuine sustainability of the built environment, we must therefore look beyond the building and we must consider all scales:
- of the **country** as a whole; through (inter)national planning
- of the **city**; through planning and urban design
- of the **microclimate** of the building and surroundings; through city design
- and of **building** itself.

Open space and nature should be conserved and buildings should be concentrated.

It is only through a more sustainable form of planning and a more sustainable form of urban design that we can create the possibility for sustainable buildings, because we will construct these in the right places.

And it is precisely here that the Netherlands has made severe mistakes in recent years.

In a short space of time **a three-part problem** has arisen:

1. Unrestrained misuse of virgin land for single-function suburbs and office parks, with a destructive effect on the spatial quality of vast tracts of the countryside. The newspapers are full with reports of how cluttered the Netherlands is.
2. Effect: an important middle-class group is moving out of the city, and that impacts negatively on the viability of services in the city.
3. Effect: a huge problem with mobility. Low-density living and working in the current manner creates a huge number of transport journeys — much more than if functions were clustered better and if public transport could play a more important role than is possible at present, in part because of the scattered nature of development and

NETHERLANDS 2040?

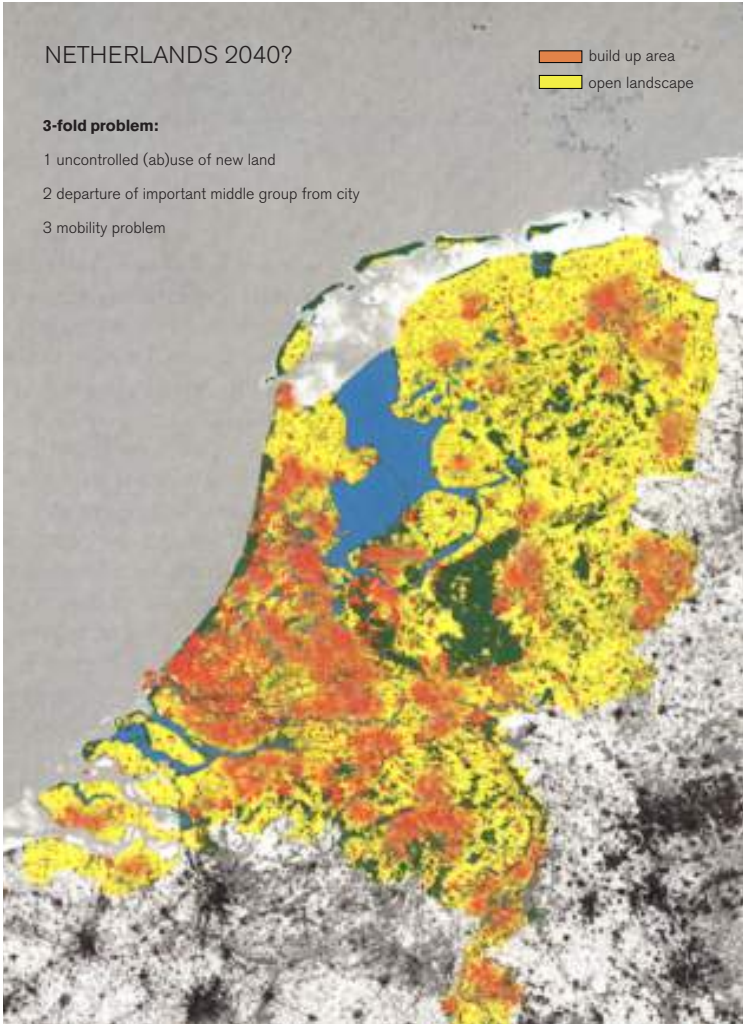
build up area
open landscape

3-fold problem:

1 uncontrolled (ab)use of new land

2 departure of important middle group from city

3 mobility problem



1

2

3

the low density.

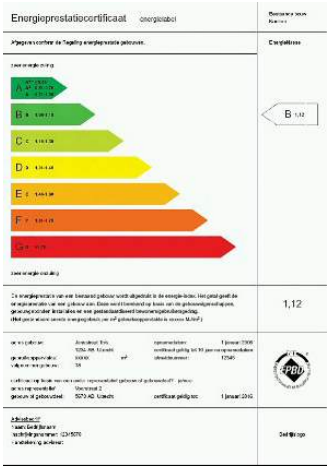
A least 10% of the pollution that warms up the earth is caused by traffic. **Urban planning that generates traffic is by definition not 'sustainable'.**

Planning choices have been made here that cannot be lasting and therefore will turn out not to be sustainable. And that means that everything built in that framework is under discussion; even if it was devised according to the prevailing definitions of what 'sustainable' was.

To reduce the severity of this three-part problem, a clear choice must be made. The remaining building program to be developed must be accommodated within the boundaries of areas already urbanized. And within those boundaries the other principles of sustainable building must be applied.

The choice is of importance, because we still have to build a lot. Despite the economic crisis, an estimate of 900,000 dwellings are to be constructed in the Netherlands within the next 20 years. And then there are all the accompanying schools, shops, places of employment, and works of infrastructure. And although much has been done wrong, we had better do the rest better.[10]

But how should be do that? After all, it means increasing densities. And that arouses negative feelings in us. We associate density with a lack of space, light, greenery and privacy, with an excess of social danger, hard surfaces, and noise. Those associations are not unfounded: we have our own miserable city in mind, or even those in rapidly developing countries (such as Seoul). And all too often, increasing density in the Netherlands means building on the last



epa
Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

GreenCalc+

breeam nl

46

GPR GEBOUW

ecoQuantum

remaining green space in the neighborhood. That's not the way to do it; another approach is called for. **We must 'increase density intelligently'.**

Quantifiable sustainability

An important issue is measuring sustainability. Which criteria should be taken into account and can these be quantified? If so, how? Owing to the growing demand, more than **50 measurement instruments** have been developed for different purposes and target groups in the construction sector.

A number of examples are the so called **'Energy Performance Standard'** and the **'Energy Label'**, both instruments from the Dutch government; the 'Toolkit for sustainable housing' is an instrument that measure ambitions for clients; the Municipal Practice Guideline (**GPR building**), is a digital assessment method that evaluates buildings with report figures for energy, environment, health, quality of occupancy, and future value. Another model, **GreenCalc+**, assesses on the basis of energy consumption, environmental impact of materials and environmental impact of water consumption; **Eco Quantum** is a policy instrument aimed at determining the environmental ambition of projects for clients and local authorities, but it is also available as a preliminary design tool for architects who want to assess a design at an early stage. It is based on energy efficient installations, water-saving techniques, choice of materials, layout, and location. **'BreeamNL'**, the assessment method of the Dutch Green Building Council, takes into consideration not only energy, material and water but also such aspects as management, transport, and use of land. That makes it the most comprehensive method currently available.[11]

Since these assessment methods employ different parameters,

selection of existing measurement instruments examples of energy-certificates, interface GPR-gebouw, logo of different instruments

	material **1** material environment energy	process **2** economy ecology sociology (cultural) history demography	space **3** spatial planning mobility scale awareness global/ regional/ local developments
EPN | EPC	energy building mass		
Energielabel, EPA	energy building mass		
GreenCal+	use of energy material water		
GPR-gebouw	energy environment	health usage quality future value	
Breeam NL	use of energy material water	management	use of land transport
Eco Quantum	energy efficient installations choice of materials water-saving techniques	organization	location
DKK		technique management sustainability economy	
DPL		environment, energy and material (district) social cohesion cultural-historical value safety, noise and odor nuisance water management and waste collection	use of space accessibility flexibility and mix of functions greenery and water in the district quality of facilities

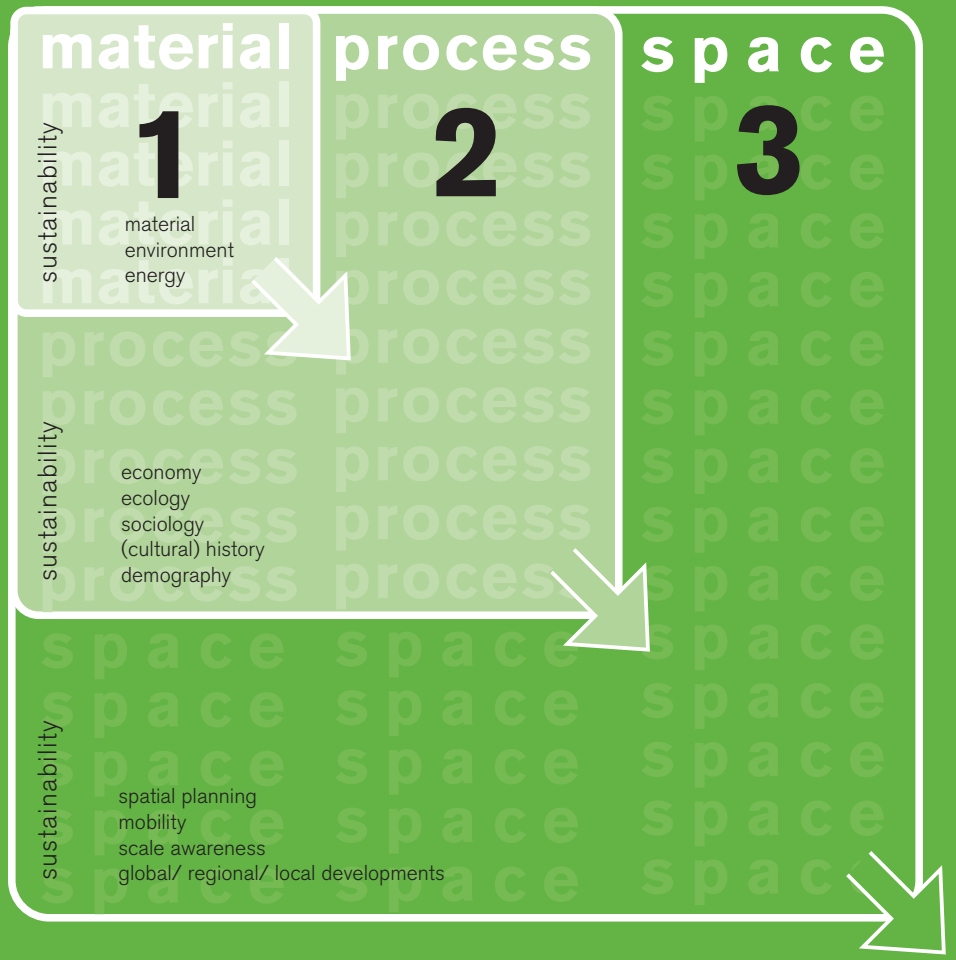
it is still difficult to compare their merits with one another. The government, however, is among a number of parties that have developed instruments that are currently working on a combination of the Energy Label and the Energy Performance Standard in order to arrive at one common language.[12]

It is striking that only the last two instruments listed include the use and design of space as aspects of sustainability – and even then largely in a quantitative sense. What is lacking is the qualitative assessment of space, and the interaction with other buildings and with the non-built environment. These aspects are, however, very important for the assessment of the total sustainability performance of buildings. Infrastructure must be put in place for a building outside the city, and that results in extra costs, energy consumption, and use of materials. A building in the city is better protected than an isolated building elsewhere, and that means energy savings. Moreover, a combination of functions also facilitates combining the use of services, and that results in space savings. A park or small-scale green area near homes makes for a very welcome amenity, and means that a dwelling could even be made smaller or lack a private outdoor space.[13] To turn these factors of spatial organization into measurable parameters, a clear definition is necessary, as in a way of expressing assessment in quantitative terms. Further study is required for that.

comparison of measurement instruments
used parameters in relation to different dimensions of sustainability

Measuring the sustainability of a building is not possible without taking location-dependent factors into consideration.

A building at the wrong location is never sustainable.


material
process
space
1
2
3
sustainability
material
environment
energy
sustainability
economy
ecology
sociology
(cultural) history
demography
sustainability
spatial planning
mobility
scale awareness
global/ regional/ local developments

SPACE

THIRD DIMENSION OF SUSTAINABILITY

Sustainability in construction goes beyond the measuring of lifespan, consumption, and reuse of material and energy. Sociocultural implications and the organization of (public) space give a new dimension. A good balance between all factors leads to genuine sustainability.

2.2 THE 'INTENSE CITY'

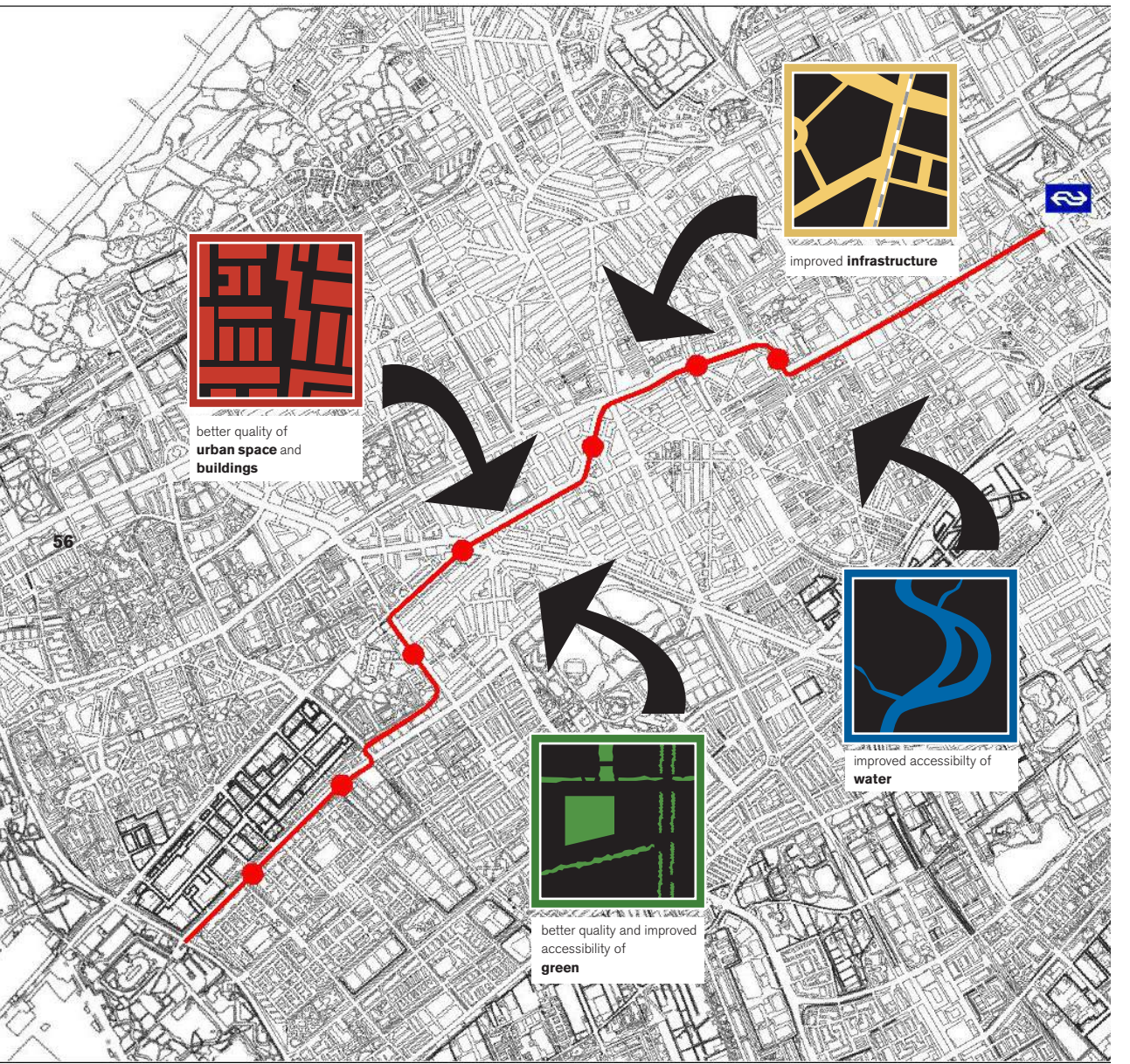
How can we increase density in a way that is in keeping with our living habits and our achievements? A number of issues must be taken into consideration.

The city in layers

Increasing the density of building development will only be a success if it is accompanied by the strengthening of other urban networks in addition to buildings. Besides more and better buildings, in spatial terms alone the networks of greenery, water and traffic are of vital importance for the appreciation of the surroundings. The interaction of people and nature is also of huge importance in the city. A city with an increased density is also a pleasant city to live in with well-organized and valuable networks of green and water within the urban fabric. Also of importance are the borders to the 'world outside', the transitions to the surrounding countryside. This must be accessible, clear and powerful. The sustainability of a building goes hand in hand with the functioning and the quality of these networks. If these aspects are ignored, then a sustainable building is unthinkable. Often, the network of greenery or water determines the value of a building to a greater extent than the building itself.

At the same time, increasing density can provide a way to repair historical structures in the city or village – such as old watercourses and larger green networks. These throw up opportunities to create an attractive urban residential and working climate. They also make it possible to respond to specific local characteristics, because there is quite a difference between Bunschoten and Maastricht, Zaltbommel and Delfzijl. We have neglected this aspect for too long with uniform

red, green and blue the concentric (water) lines of the canals in Amsterdam


improved **infrastructure**
better quality of **urban space** and **buildings**
improved accessibilty of **water**
better quality and improved accessibility of **green**
56

urban design. That means a tailored approach to each city or village – based on its particular characteristics and qualities. This demands thorough analysis. Successful urban design does not end with high density. It will prove a success if it responds to the particular qualities of the city; only then can we speak of a success.

sustainability ~ restoration of site-specific structures

Is it really affordable?

Increasing density offers us the means to drastically improve the atmosphere and quality of the urban residential environment. More buildings, more amenities, more greenery, more water, and a clearer character and local flavor.

A paradox?

Absolutely not.

And feasible? Certainly; there is plenty of space within cities and towns. And financially possible? The depletion of fossil fuels and the accompanying expected rise in energy prices will create a new reality. Moreover, advancing awareness of the scarcity of undeveloped land and the revaluation of land prices in relation to those in the existing city can have a drastic effect on the current relation between the city and countryside. Construction of higher-quality development in the city increases the choice and can help house prices and rental prices to normalize. As a result, living in the city can become attainable again for the intended 'returning residents' (particularly the financially important middle class. A more integral approach to all the costs that arise out of construction work offers a completely different picture of the relation between the costs – compared to building on 'virgin land'. In the city the infrastructure of roads and technology is already in

city in layers - VELOV research project Tangram; possiblities of densification along a public transport lines between center and periphery of the city, The Hague


Donnybrook Quarter, Londen, Peter Barber Architects


Blok 29, IJburg, Tangram


Schuttersveld, Delft


Scheepstimmermanstraat, Amsterdam


Het Funen, Amsterdam, de Architekten Cie


Collective housing, Zurich, Camenzind Evulotion

place. A more effective use of existing amenities such as shops and public transport ensures an improvement to the economy of the city – and residents can in turn benefit from that. Finally, the social costs of the advancing segregation between different population groups as a result of migration out of the city and social unrest that follows must also be taken into account. A better functioning city can be a precondition for a better quality of life for many people.

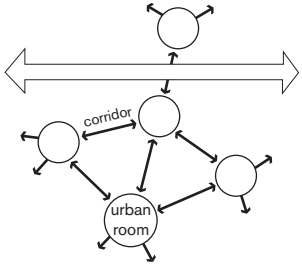
Identity of the compact city

It is a mistake to think that increasing density leads to highrise development. That is not necessary! Good densities can also be achieved with lowrise forms of development. This is very important in an era of small-scale serial development where phased development must be an option. Moreover, variation of what is available is good for the individuality, the recognizability, and the possibilities of developments. Combinations of lowrise and stacked structures are also very interesting – and stacking can take many forms.
An end to monotony!

Microclimate: building and direct surroundings

The quality of public space is decisive for a good appreciation of the intensively used city. This varies in scale and character – and can be small in area but should be detailed to a high standard. Urban space can be considered as a sequence of urban rooms, with possibilities for encounters and activities, connected to one another by urban corridors. Buildings located on these spaces must respond to the space around them. That can result in a gradual, orchestrated transition from public to semipublic and collective space to private space. This can contribute significantly to the enjoyment of the occupants of buildings in the city.

examples of intensive low-rise construction the interaction between the residential units or residential structures and the (semi-)public space around them plays an important role in such projects



The sustainability of a building is not about the building alone but is connected to our appreciation of the building's immediate surroundings, in terms of both the potential for expression in public space and in the interior.
The sustainability of a building is about dealing respectfully with the living and working surroundings, public space, and greenery.

Green impulses in private and public space

No place or building in the urban fabric is as sustainable as urban green space. It is a well-known fact that people thrive when living and working in buildings with a healthy climate that are well-scaled and can be adapted to meet the wishes of occupants and receive sufficient daylight. In addition, there is a clear demand for outdoor green space, whether public or private. These conditions should be met in the pursuit of sustainable buildings.
But it doesn't end at the level of the building. The highest degree of appreciation (and hence also sustainability) for a building is derived from the quality of the space around it. A building developed according to the Cradle to Cradle philosophy yet built on a site that is not appreciated cannot therefore be termed sustainable. Every development, whether it takes place inside or outside the urbanized area, will therefore be directly related to the strengthening and increasing of the green character of public space, which should be a primary goal. This means that public space should be well designed and carefully attuned to the existing development and vice versa. And it should preferably boast as much greenery as possible.
Research has revealed that greenery in the living environment is crucial for the wellbeing of people. The study by Jolanda Maas even notes a direct relation between health and greenery in the living environment.[14]

And although it sometimes sounds contradictory, every building development should stimulate a strengthening of the green network. Green interventions can take place inside a building where plants, trees and water have a positive effect on the interior quality of a structure. But particularly when it comes to increasing density in inner-city areas, the development of greenery is essential for sustainability. Green contributes to atmosphere, softens space, improves air quality, reduces noise pollution, and improves privacy, liveliness, protection, shelter, and shadow. In short, it is essential in areas where density is increased. The sustainability of a building should therefore be measured according to the extent to which a building or building development contributes to the strengthening of the green and blue qualities of space.

sustainability ~ adding greenery and water

urban farming ultimate form of green in the city (example on the left: Prinzessinnengarten, Berlin; next page: residents working in their neighborhood garden in Amsterdam West)

True
sustainable construction
generates
positive social and
economic processes via a
comprehensive approach
to morphology, green
structures and water, local
history and identity.

sustainable: concrete

Pantheon, Rome, 126 CE

sustainable: wood

Kinkaku-ji, Kyoto (Golden Pavilion),

1398

sustainable: metal

Seagram building New York

1958

not sustainable: concrete

Maupoleum Amsterdam

1971; demolished 1992

not sustainable

Bijlmer, Amsterdam Zuidoost

construction from 1966; 2000-2010 large-scale demolition / replacement / major restoration due to serious (social) problems in the district

2.3 SUSTAINABLE BUILDINGS, SUSTAINABLE CITIES, SUSTAINABLE SPACE

Appreciation and usefulness

The most sustainable architecture is architecture that still functions well and is appreciated after many years. This has to do with much more than the practical usefulness and constructional reliability. A sustainable building can be constructed in all materials imaginable – if it lasts, it's sustainable.

Which criteria must we consider in assessing sustainability? There are many, but some are prominent. A building occupies **space** and can help to shape it. The careful organization and economical use of available space are essential. A good interpretation of the location must lead to an interaction with the surrounding urban space; a good integration and interaction with the surrounding nature in the city and the addition of nature (even in the city) leads to green urban plans, for example through the use of rainwater or the addition of green areas on the site and facade. A sustainable building uses little or no **energy**, or is preferably zero-carbon, which is to say that it supplies its own energy needs in all seasons. The loss of energy must be compensated for by generation in the summer in combination with heating and cooling storage. **Time** does not harm a sustainable building: by helping to design the preconditions for changing functions (flexibility), one can secure the future value of a building. Much needs to be considered in choosing the **material**: the nature of the material (renewable or nonrenewable resource), the method of extraction and the energy that requires, and the energy needed to transport it to the place where it is processed, the potential duration of its use, maintenance during use, possibility to reuse it after demolition, and pos-


GREY WATER
RE-USE
RAINWATER
NIGHT VENTILATION
ENERGY
TIME
FLEXIBILITY
LIVING ENVIRONMENT
MAINTENANCE
USAGE TIME
ENERGY PERFORMANCE INDEX
APPRECIATION
EN
AESTHETICS
LIFETIME
TRANSPORT ENERGY
GEOTHERMIC HEAT STORAGE
UPCYCLING
ENERGY PRODUCTION
NETWORK
ECOLOGY
DEMOLITION
MATERIAL
GREEN SURFACE
GEOTHERMIC COLD STORAGE
LOCATION-SPECIFIC
RECYCLING
SPACE
DOWNCYCLING
COMPACTNESS

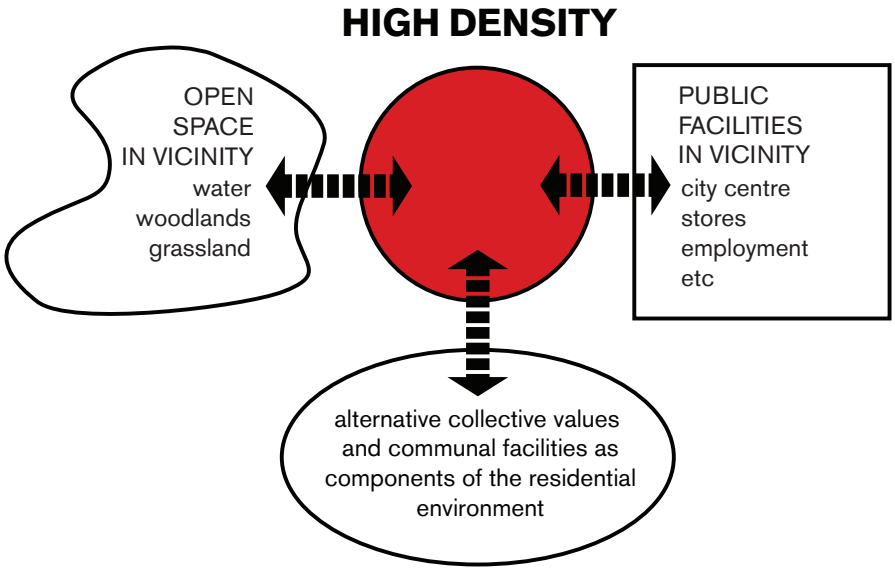
sibility to recycle it for other purposes. Finally, a commonly forgotten aspect of sustainability: **appreciation and aesthetics**. A building people appreciate has a longer life expectation.
Sustainability of the built surroundings is therefore not simply about the production of built objects and places and their performance when used. It is also about how they are appreciated, what they represent and symbolize.
The quality of appearance is therefore more than a subjective quality; a good design is more than a statue erected in honor of the architect.

Making choices

Not all imaginable measures for sustainability can be applied at the same time: choices must be made in the design of a building. These choices will mostly concern the possibilities and limitations of the location. Sustainability in a metropolitan setting has more to do with the efficient use of land, combined energy services and flexibility and less with the creation of a lot of greenery. In non-urban locations a green roof (where a lot of water is stored in the soil layer) is difficult to combine with the storage of rainwater for household use. There are also limits to the application of solar panels on facades, since views out and a pleasant appearance are of importance to the appreciation of the building. The art is therefore to find the right **balance**.

$$\text{sustainability in urban setting} \sim \frac{\text{lifespan x reuse x sociocultural factors x quality of space x amount of greenery water}}{\text{(energy consumption + use of space) x (building + infrastructure)}}$$

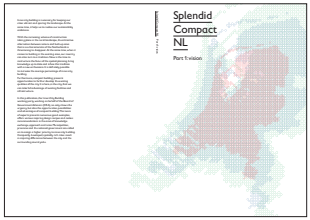
PRECONDITIONS FOR BROAD ACCEPTANCE OF HIGH DENSITY



RELATIONSHIP DENSE CITY AND OPEN SPACE

Living in the dense city is acceptable, if you have the feeling that you are able to escape or to air air out.. Open space close by in town or just at the city edge is essential. But other compensation helps: good amenities nearby and a sufficient degree of informal community sense facilitated by a well designed public space.

2.4 DESIGN OF A SUSTAINABLE CITY



In the further sustainable development of the Netherlands, a large number of very different recipes can prove useful. The recipes concern different scales of operation.
These were previously published in Splendidly Compact NL[15], a guide written by TANGRAM in collaboration with Rudy Uytenhaak for the Chief Government Architect as a set of guidelines for future national spatial policy. (available from the Chief Government Architect's office.

Some design recipes

The recipes for the design of a sustainable built environment concern many facets:
- strategies for city design (a good approach is essential for the success of the process of urbanization);
- spaciousness (high quality in the city);
- interaction between urban dweller and nature (of vital importance in the city too);

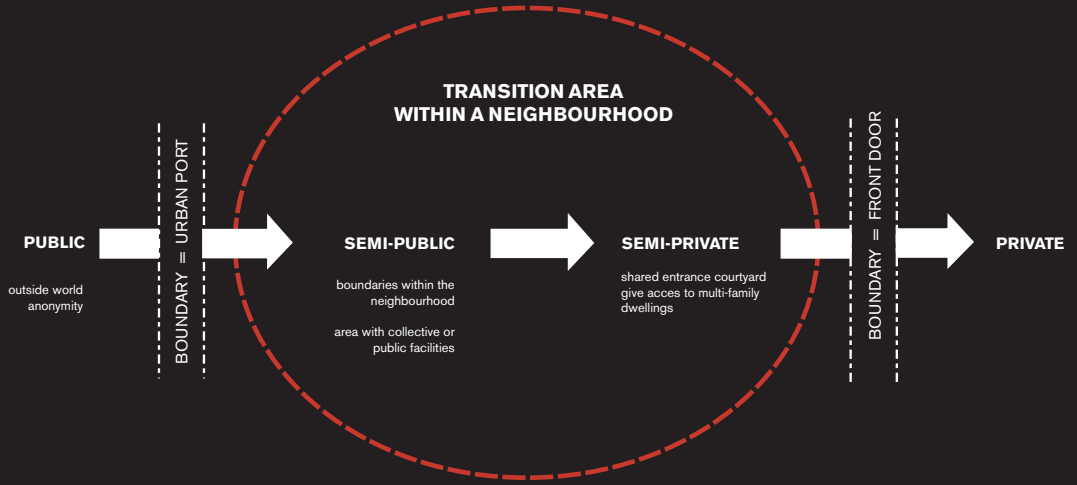
A wide range of possibilities are shown in Splendidly Compact NL. Here are illustrations of the Top 10, marked according to the scale and nature of the recommendation. And especially: the greenest examples.

Scale levels

The recipes cover different levels of scale. These are explaned on the following pages.

CAREFULLY DIRECTED GRADUAL

TRANSITION FROM PUBLIC TO PRIVATE



LEVEL OF SCALE

URBAN FABRIC
scale of a city, district or neighborhood; structure of the public space

MICRO-CLIMATE: CITY–BUILDING TRANSITION
Scale of a block, street or square; transition from the public to the private

BUILDING
Organization of a building and its immediate environment; the furnishing of a building and its own terrain; the relationship between inside and outside

THE URBAN SCALE

THE CITY AS A SEQUENCE OF CORRIDORS AND URBAN ROOMS
imprints itself in the mind of the resident/visitor as a readable system

QUALITY AND COHERENCE / PUBLIC SPACE
How the urban room is furnished is of prime importance to its ambiance

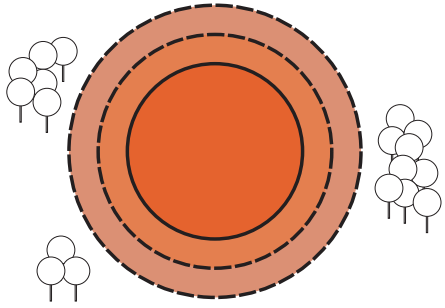
GREEN AND BLUE
green impulses in the city, by incorporating new greenery and water, are made possible by introducing additional building program

MICRO-CLIMATE: A BUILDING AND ITS IMMEDIATE ENVIRONMENT

TRANSITIONS FROM THE PUBLIC TO THE PRIVATE
Good organization of a building's functions with regard to the street; clearly demarked zones for both traffic and sojourn; the open and the closed, public and private, are conducive to the appreciation of the urban structure

URBAN PROGRAMME GROWS

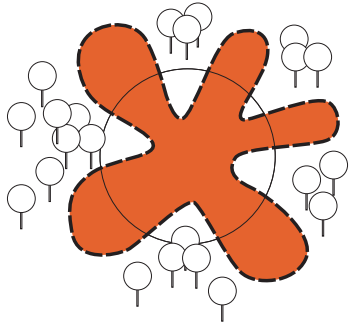
DICTANCE GROWS



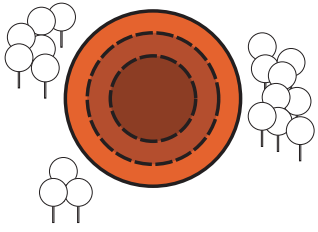
THREAT OF POOR RELATIONSHIP
BETWEEN CITY CENTRE AND PERIPHERY

MODEL LOBE CITY

OR



OR



MODEL COMPACT CITY
(INTERNAL EXPANSION)

1. KEEPING THE EDGES OF A BUILT-UP AREA NEARBY

The city dweller must feel he/she can leave the urban environment at will. In the case of larger cities, green lobes are a good solution.

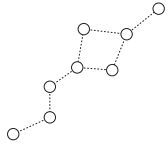
2. CLEAR SPATIAL RELATIONS

Spatial expression communicates a feeling of space. When intensifying, we must not be afraid to add contrast between minimal dimensions with correspondingly more spacious proportions. Urban tensions and contrasts are the key to creating an interesting city.




3. THE MEANINGFUL PUBLIC SPACE

Has cultural, functional or historical meanings, and has either green or carefully selected stone-like furnishings; developed in accordance with a program of urban-planning requirements and distributed in corridors or 'rooms.'



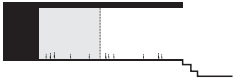


4. SPACE FOR GREEN

Green is the first prerequisite for a pleasant residential environment. Structures with good penetration and green urban rooms are prerequisites for appreciating the city.

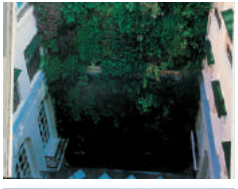
5. SPACE FOR WATER

Climate change means more problems from water. At the same time, the ground surface becomes less permeable due to increased amounts of hard paving. This results in an increasing need for storage and drainage of water. The spatial claim and visual quality of water offer opportunities for high-quality residential environments.



6. PUBLIC LIMITS WITHIN THE LIMITS OF THE BUILDING

Through a spatial mixture in buildings with adjacent public space, such buildings return space to the city, with the result that urban life can breathe within it. Green and water penetrate the building.



7. TRANSITIONS BECOME GREEN

Green softens the effects of densification. It influences how we experience the space. As space diminishes, our appreciation of green only increases.

8. COMPACTNESS, ENERGY AND ECOLOGY GO TOGETHER

A careful placement of buildings within the city can lead to substantial improvements in energy efficiency. Compact plans provide opportunities for collective energy facilities, e.g., underground seasonal thermal storage. Combining functions makes both dual and efficient use possible.

9. OUTDOOR SPACES AND PRIVATE GREEN STRUCTURES

Are essential to the appreciation of the dense urban fabric. Here, quality is often, but not always, linked to the dimensions employed. Small can be quite beautiful. Protection from, and, respectively, exposure to, the sun are universally valued.

10. LIGHT AND REFLECTION AS GENERATORS OF SPACE

Materials and textures can contribute to the illusion of space. Reflective materials add perspective and duplication. Light brings depth and multi-layeredness, often leading to optical enlargement of small spaces.

BALANCE

SUSTAINABLE BUILDINGS ARE:

Culturally appreciated, particular to a location, flexible and adaptable, developed with the use of low-energy materials and with concern for transport, construction systems, and future re-use of material, with an optimal energy consumption of the building during its lifespan as well as a minimum material and energy demand for the supporting infrastructure and its users in an area whose density has been increased intelligently with a positive effect on the green and blue structures in and around the built fabric and with a minimum use of space but a maximum positive impact on public space

Sustainability is the BALANCE between material, energy, and use of space.

5 EXAMPLE

NATURE
RECYCLING
PEOPLE
SHRINKAGE
NATIONAL DEVELOPMENT
SUSTAINABILITY
PRODUCTION PROCESS
ECOLOGY
INFRASTRUCTURE
SUSTAINABILITY
REGENERATIVE ENERGY
PUBLIC SPACE
ENVIRONMENTALLY FRIENDLY MATERIAL
GLOBAL DEVELOPMENT
FLEXIBILITY
HEALTH
EMISSION
MIX OF FUNCTIONS
TECHNIQUE
SUSTAINABILITY
GEOTHERMAL HEAT STORAGE
GROWTH
LIFETIME
LOCAL DEVELOPMENT
SPACE
SUSTAINABILITY
ECONOMY
SAVING ENERGY
RESOURCE
DENSITY

3 PROJECTS

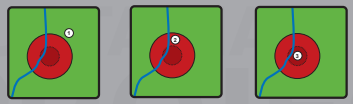
OF TANGRAM'S REPERTOIRE

ON DIFFERENT SCALE LEVELS

ON DIFFERENT URBAN LOCATIONS

WITH EACH ITS OWN BALANCE OF SUSTAINABILITY

LOCATION



Spatial relationship to existing built-up area

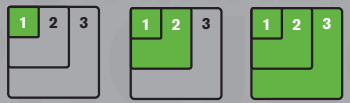
1. highly urban (city centre)
2. urban (by green and water)
3. city boundary

LEVEL OF SCALE

Spatial scale levels

1. building
2. transition city - building
3. urban fabric

SUSTAINABILITY DIMENSION



Dimension of sustainability

1. material
2. process
3. space

SUSTAINABILITY FACILITIES

Overview most important aspects

sustainability aspects can relate to both the building itself as a relation of the building with the surrounding area

READING GUIDE FOR PROJECTS

In this chapter an analysis of 5 Tangram projects will show their different balances of sustainability. The examples are graded according to the aspects mentioned and explained in the last chapters as decisive factors for assessing the sustainability of buildings and built environment (see explanation on left page).

The selection criteria for the projects were **scale level** and the **positions in the city**:

Cité, Rotterdam
position: highly urban; scale: overgang stad - gebouw

Crystal Court, Buitenveldert
position: urban, by green and water axis;
scale: transition city - building

Lux, Almere
position: expansion location; scale: building

Waterwoningen, Osdorp
position: city boundary; scale: building

Park Laar, Tilburg
position: urban; scale: urban design

Based on a series of questions the same issues are examined and measured for each project in order to compare their degree of sustainability.

The questions concern the building and its spatial context.

The following factors are examined:
- accessibility
- use of space and facilities
- location-specific characteristics, green and water structures
- compactness, density and mix of functions
- use of energy and materials

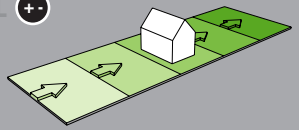
The analysis results in a sustainability rating in two labels. The **building label** is an indication of the level of sustainability of the building. This involves the use of materials, the insulation of roof and facade, the extent to regenerative energy sources is realized.
The **space label** is an indication of the impact of the building on its spatial context and the interaction between building and environment. These include the spatial, aesthetic and functional relationship what makes the valuation so complex. It is rather difficult to to express such aspects quantitatively - and thus objectively Much more important is the assessment in terms of quality.

Obviously, the results are highly subjective. This approach should be considered as attempt to move forward the discussion of measuring sustainability. Specified research is required to develop a useful measuring system.

BALANCE

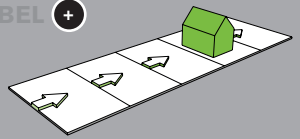
BALANCE space
assessment of the relationship and interactions of the building and the environment

SPACE-LABEL +-



BALANCE building
valuation of the building itself, based on aspects such as sustainable material and energy, insulation, technical sustainability facilities

BUILDING-LABEL +

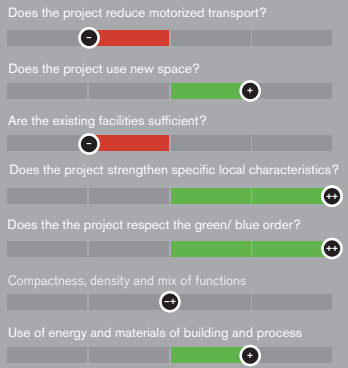


OVERVIEW SUSTAINABILITY ASSESSMENT

negative assessment

positive assessment

neutral assessment
(or aspect is not applicable)



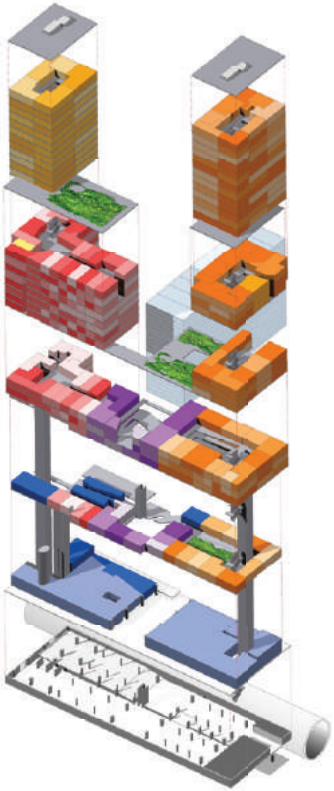
CITÉ ROTTERDAM

commissioned by Stadswonen Kristal, Rotterdam
short description 494 apartments (30, 45 and 65 m2, partially linkable); shared facilities (ca. 400 m2); work rooms (ca. 550 m2); commercial facilities: 2,400 m2; garage accommodating 135 cars. Total: 33,000 m2
status completed, 2010

Located in Rotterdam's Kop van Zuid, Cité is a residential structure for so-called short-stayers (students and expatriates), and features collective and commercial facilities, work units and parking facilities. It forms part of the 'framework plan' devised by Erick van Egeraat Associated Architects (EEA): a three-dimensional program of urban-planning requirements. Besides the new headquarters of the UWV the enlargement of the InHolland College, also designed by EEA, is part of the plan. It forms a 'bridge building' which leans against the atrium of Cité and extends across the metro line that transects the area. A handy distribution of the rooms has made possible a 20% densification of the number of residential units desired as compared to the original program. This in turn makes it possible to employ a richly detailed facade and generously designed atrium space, whilst not exceeding the budget allocated for the project. The atrium, which extends over several floors, forms a semi-public intermediating space, enabling urbanity to be, as it were, brought into the building, and making human encounters central. Through the great concentration of functions and residential facilities here, which effectively stand directly above a metro station (Wilhelminaplein), this is an example of traffic-efficient building (junction development).

Although the building-physical elaboration of the facade can be characterized as good (but not special), numerous sustainability facilities e.g., a seasonal thermal storage system shared with Inholland, use of the roofs for solar collectors and green and the building's extreme compactness and layout flexibility, ensure an above-average degree of energy efficiency. Cité is one of the first projects in the Netherlands where residual heat use is combined with heat pumps and energy storage. Located beneath the adjoining Hogeschool Inholland, the building's power generator is able to provide not just heating, but cooling, as well, to the building's rooms, both sustainable. As all of the building's residential units and commercial spaces are equipped with concrete core activation, its concrete structure is 'charged' with cooling and heating at night. This limits the requisite capacity during the day. Warm water for homes is generated centrally using solar collectors and a solar boiler system, yielding a substantial economy in energy use. All homes are equipped with a smart regulating system that adjusts ventilation and heating based on use.

conclusion: **balance space** ++ **balance building** ++



dwelling 65m2
dwelling 45 m2
dwelling 30m2
living-working
collective spaces
commercial spaces

bicycle parking

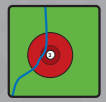
metro tube

exploded view with indication of functions

floor plans ground floor | 1st | 2nd floor

section atrium with building InHolland and metro tube

LOCATION HIGHLY URBAN



LEVEL OF SCALE BLOCK | ENSEMBLE

SUSTAINABILITY DIMENSION

SUSTAINABILITY FACILITIES

compactness,

two-fold spatial use,

flexibility,

seasonal thermal storage (STS),

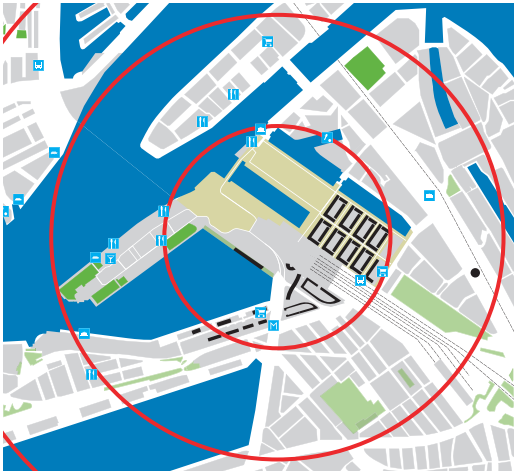
combined energy consumption with neighboring buildings,

home automation

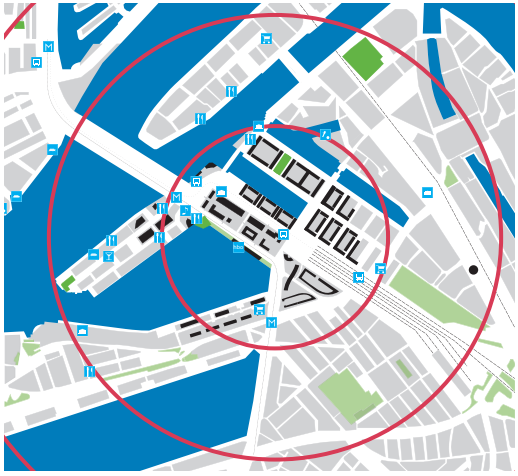
ACCESSIBILITY

location in relation to city

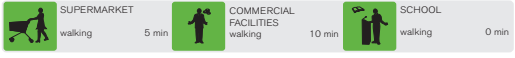
Does the project reduce motorized transport?



location in relation to district original situation



location in relation to district new situation



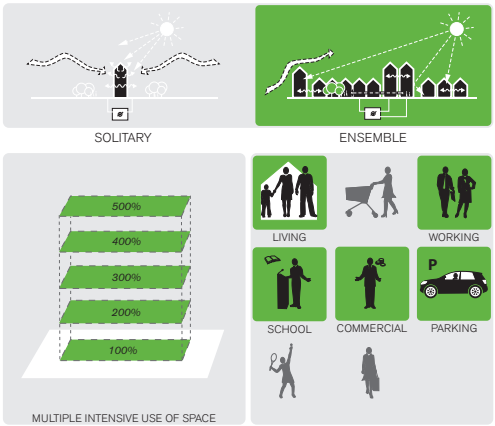
Does the project use new space?

Are the exisiting facilities sufficient?

LOCATION-SPECIFIC CHARACTERISITICS, GREEN AND WATER STRUCTURES

typical characteristic of Rotterdam/ Kop van Zuid: Cité part of a series of sturdy urban blocks

COMPACTNESS, DENSITY AND MIX OF FUNCTIONS

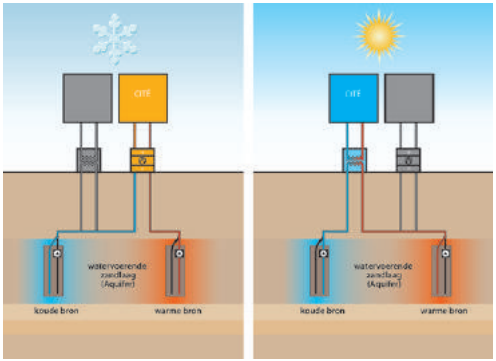


Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions

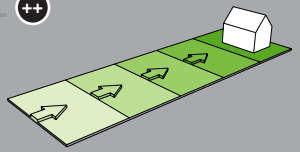
USE OF ENERGY AND MATERIAL AT BUILDING LEVEL



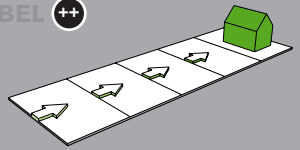
Use of energy and materials of building and process

BALANCE

SPACE-LABEL ++



BUILDING-LABEL ++



OVERVIEW SUSTAINABILITY ASSESSMENT

Does the project reduce motorized transport?

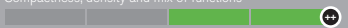
Does the project use new space?

Are the existing facilities sufficient?

Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions



Use of energy and materials of building and process

CRYSTAL COURT AMSTERDAM BUITENVELDERT

commissioned by Hillen & Roosen
short description 36 detached stacked villas
status completed in 2009

The residential sculpture, 'Crystal Court,' in Amsterdam's Buitenveldert district features maximum densification and a new form of intermediating space: a social and climatological buffer. The task had been to 'densify' a residential program at the edge of Aemstel Park on the green space of a small, now defunct, school. The existing program could have meant a serious blow to the residents' view of the park. Retaining this view became the starting point – despite the rest of the comprehensive program. The goal was achieved by means of several free-standing sculptures that stand on bases which occupy a minimum of space, with the sculptures themselves expanding in size at an elevation above the ground. The intermediating space formed by these unusual volumes was in turn captured in an intermediary: the glass atrium. This space has a variety of functions: as a socially secure transition area, as an outdoor area for the homes in winter and as a climatological buffer that contributes to energy efficiency. The water, with indigenous aquatic plants, is also multifunctional: as a privacy buffer vis-à-vis the homes on the lowest level, as a building-physical conditioning and as a visual element: the attractive water garden, which adjoins the parking facility, reflects both light and space and contributes greatly to the overall spatial effect.

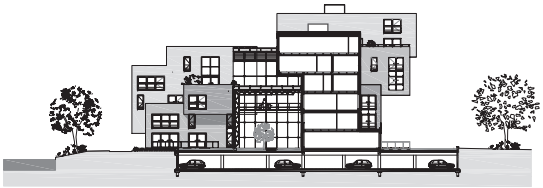
This arrangement was only realizable thanks to new constructive techniques involving a combination of prefab walls with a system of hollow floors, yielding unlimited layout flexibility, including for kitchens and bathrooms.

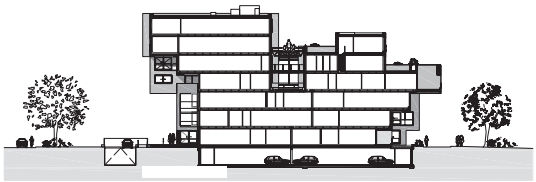
At the urban level of scale the balance is good: a densification that constitutes an enrichment for the neighborhood.

At the level of the building, the balance is quite good, but could have been even better, through the use of heat storage and higher insulation values.

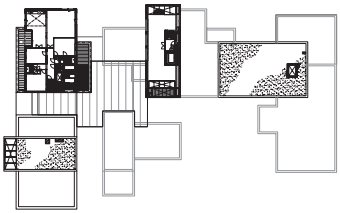
conclusion: **balance space** ++ **balance building** +

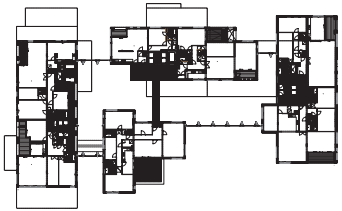
concept sketch

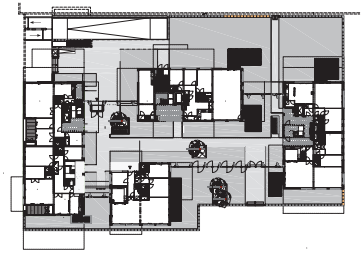




sections housing blocks around collective atrium

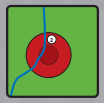






floor plans ground floor | 2nd floor | 6th floor - great variety of dwellings

LOCATION URBAN, BY GREEN AND WATER



LEVEL OF SCALE BLOCK | ENSEMBLE

SUSTAINABILITY DIMENSION

SUSTAINABILITY FACILITIES

harmonization within the context;

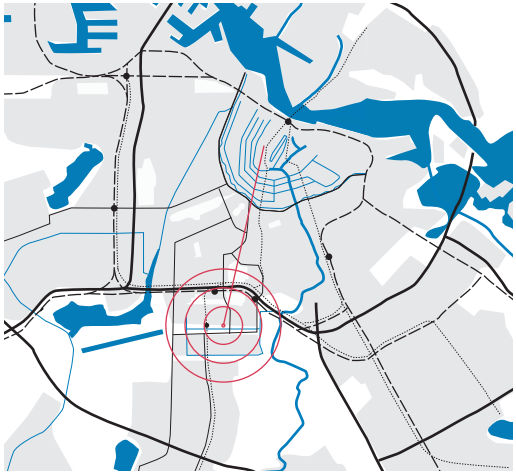
heat extraction and storage;

unlimited flexibility of layout and use as regards types and numbers of dwelling as well as within these;

compactness;

green and water in building except for in car park;

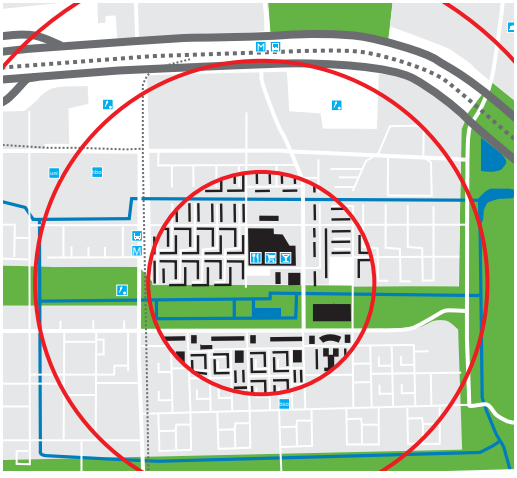
ACCESSIBILITY



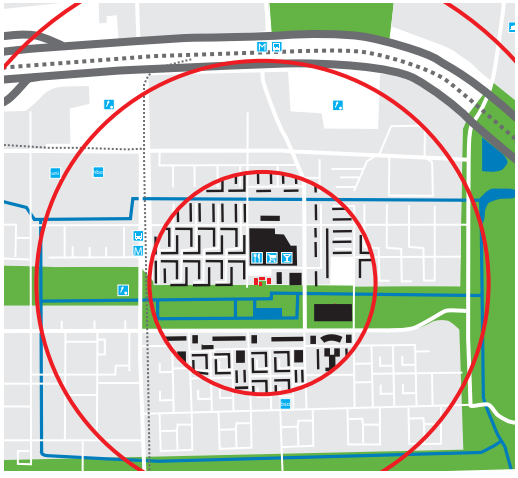
location in relation to city

CYCLING		
city centre	20 min	
station Zuid/WTC	5 min	
bus stop	2 min	
PUBLIC TRANSPORT		
city centre	30 min	
station Zuid/WTC	10 min	
CAR		
city centre	20 min	
station Zuid/WTC	10 min	
highway exit	2 min	

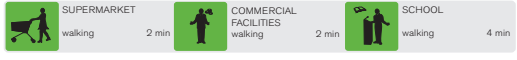
Does the project reduce motorized transport?



location in relation to district original situation



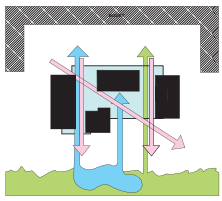
location in relation to district new situation



Does the project use new space?

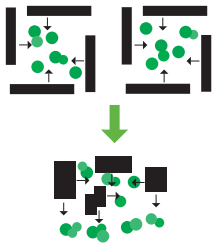
Are the exisiting facilities sufficient?

LOCATION-SPECIFIC CHARACTERISITICS, GREEN AND WATER STRUCTURES



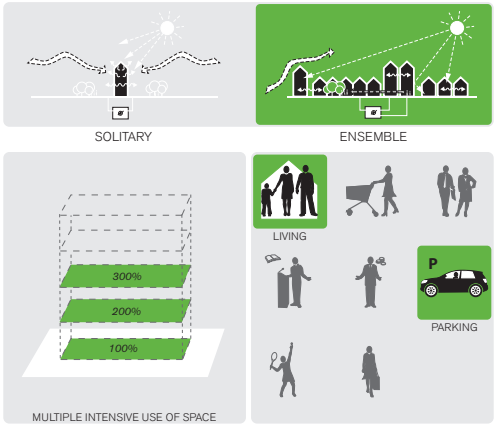
Gijsbrecht van Aemstelpark
is continued inside the building

typical allotment of Buitenveldert,
Van Eesteren 1958



living in green environment

COMPACTNESS, DENSITY AND MIX OF FUNCTIONS



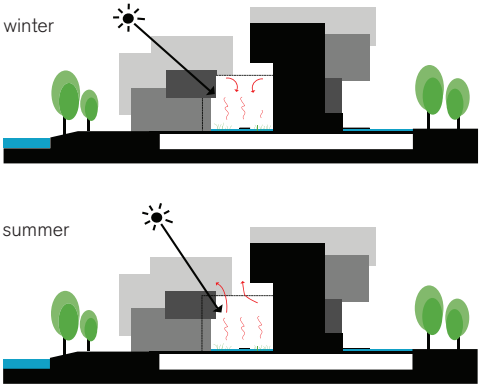
Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions

USE OF ENERGY AND MATERIAL AT BUILDING LEVEL

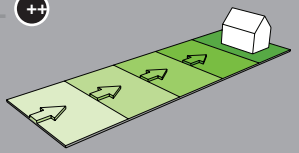
ponds and plants regulate humidity of atrium



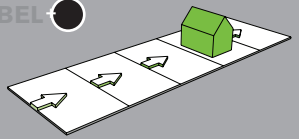
Use of energy and materials of building and process

BALANCE

SPACE-LABEL ++



BUILDING-LABEL -



OVERVIEW SUSTAINABILITY ASSESSMENT

Does the project reduce motorized transport?

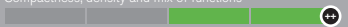
Does the project use new space?

Are the existing facilities sufficient?

Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions



Use of energy and materials of building and process

LUX ALMERE

commissioned by Ballast developers, in cooperation with BAM project developers
short description ca. 120 apartments in a range of types and sizes, constructed parking facility
status definitive design in progress; expected completion: 2011–2012

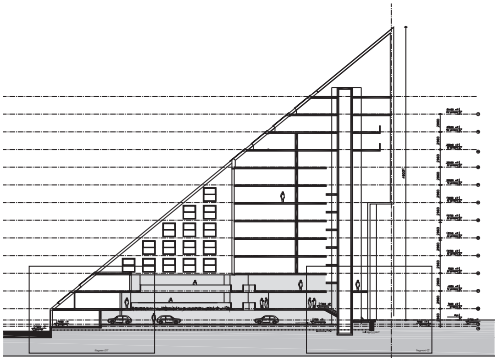
In June 2009, the Municipality of Almere declared the C2C principles (see above) to be official municipal policy (translated as 'The Seven Almere Principles'). Plans were recently launched for the addition of 60,000 homes, a number of ecological islands in the Markerwaard landscape and a rail connection to Amsterdam under the IJ Bay. A portion of this project is already in progress: the Columbus Quarter. At this location, the municipality has cleared space for an apartment building that is to become nothing less than an icon for the 'Almere Principles.' The building, appropriately named 'Lux,' forms part of an urban green zone incorporating special commercial development; concept by TANGRAM.

Starting points of the project are complete self-sufficiency in respect of heating and electricity, made possible through the application of active and passive solar power in obliquely positioned conservatories, and of active solar power via solar cells in the non-transparent surface of the structure's glass facade. The facade is turned and tilted to optimize the yield from incident sunlight. The two other facades of this pyramid-shaped building, which have less sun exposure, are structured in layers provided with wooden paling for overgrowth and a tilted-back, more closed facade surface.

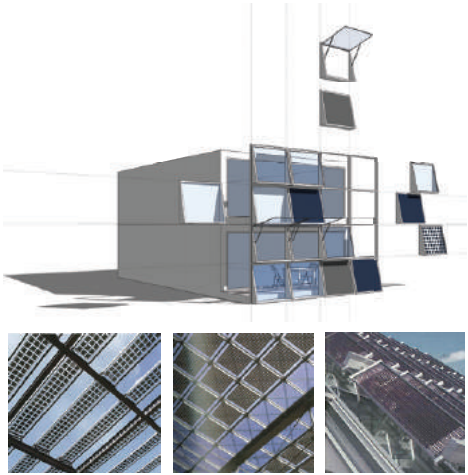
The entrance area consists of a large atrium, functioning, amongst other things, as a meeting area for residents, with a glass roof that ensures warmth provision to the building's general circulation spaces. The concrete framework is shaped in such a way that home sizes and types can be modified without the need for large-scale interventions.

The structure nevertheless remains somewhat a maverick. Located at a substantial distance from facilities (with a resulting compulsory parking norm of 1.7) and in the middle of previously undeveloped, or 'new' land, the project cannot be classified as sustainable, even in the broadest sense. The adjacent future commercial park, of which Lux forms part, does, on the other hand, signify a big step in the right direction. The building itself does embody aspects of sustainability – the location is more controversial.

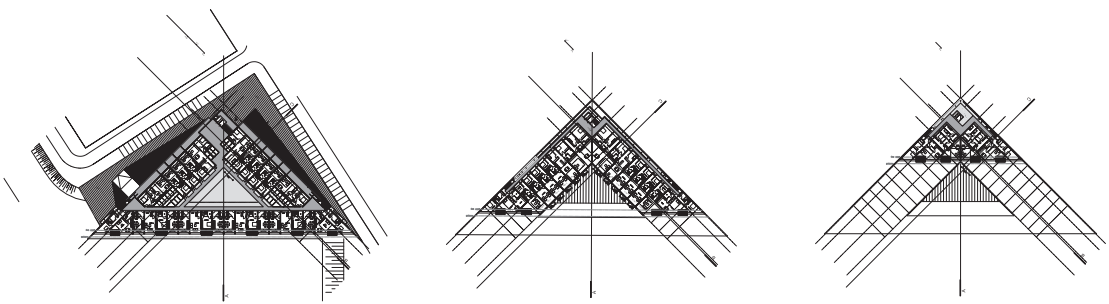
conclusion: **balance space** +- **balance building** ++



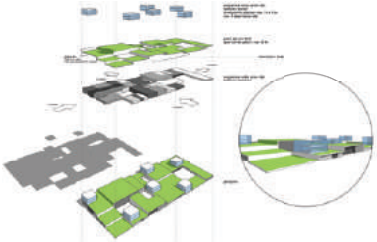
section A-A dwellings, atrium, parking

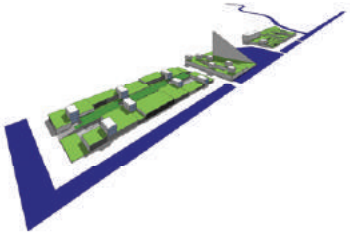


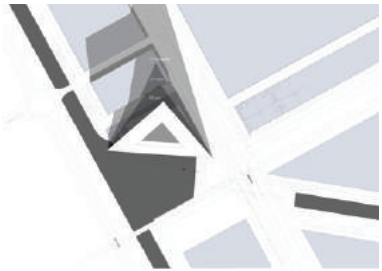
modular wall composed of elements per apartment, choice of glass solar panels, solar panels and stained glass, or just plain glass



floor plans ground floor | 2th floor | 8th floor





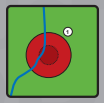


location Lux is situated in a business park located on the main access route in Almere Poort. In a study commissioned by the municipality of Almere, TANGRAM has examined the possibility of implementing adjustable size (also in time) business units in the urban plan with shared facilities including a green roof for recreational use and a cogeneration unit.

green facade at the northeast and northwest facade

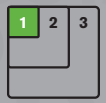
atrium as heat trap and social meeting area

LOCATION EXPANSION LOCATION



LEVEL OF SCALE BUILDING

SUSTAINABILITY DIMENSION



SUSTAINABILITY FACILITIES

energy self-sufficiency

unlimited flexibility of use

green facades and roofs

active solar power

compactness

iconic for Almere's C2C program

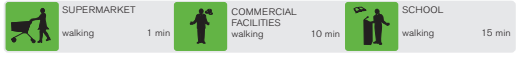
ACCESSIBILITY

location in relation to city

Does the project reduce motorized transport?

location in relation to district original situation

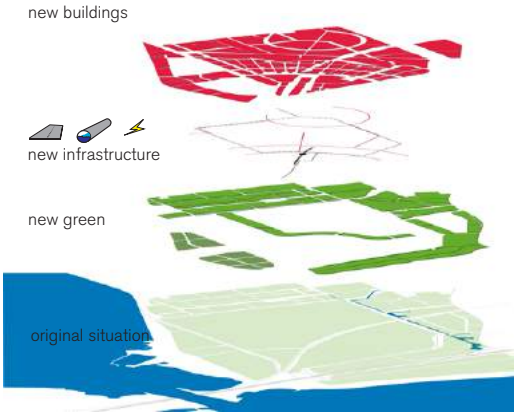
location in relation to district new situation



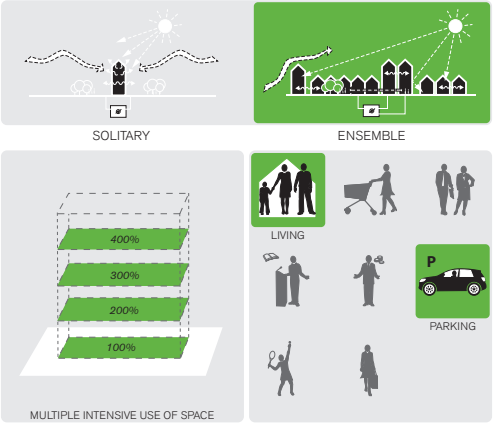
Does the project use new space?

Are the exisiting facilities sufficient?

LOCATION-SPECIFIC CHARACTERISITICS, GREEN AND WATER STRUCTURES



COMPACTNESS, DENSITY AND MIX OF FUNCTIONS



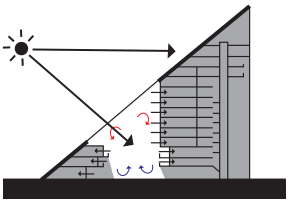
Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

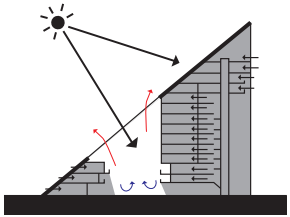
Compactness, density and mix of functions

USE OF ENERGY AND MATERIAL AT BUILDING LEVEL

winter



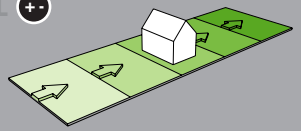
summer



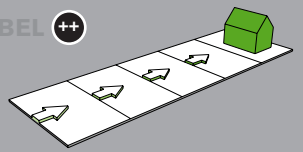
Use of energy and materials of building and process

BALANCE

SPACE-LABEL +-



BUILDING-LABEL ++



OVERVIEW SUSTAINABILITY ASSESSMENT

Does the project reduce motorized transport?

Does the project use new space?

Are the existing facilities sufficient?

Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions

Use of energy and materials of building and process

WATER DWELLINGS AMSTERDAM OSDORP

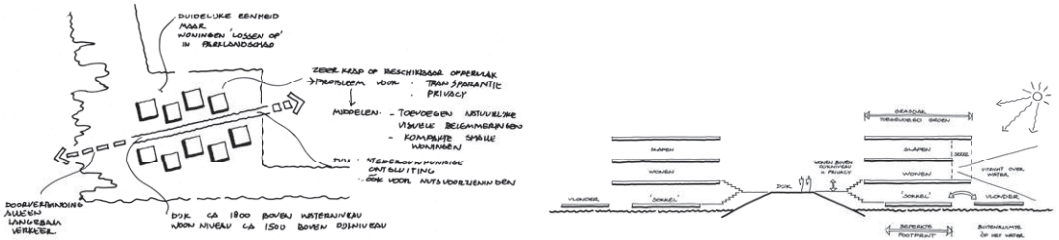
commissioned by SBDN VOF, Warmenhuizen/Beverwijk
short description 18 homes in a timber-frame construction on a concrete plinth in water along the Schillingdijk
status completed, 1999

In the ecological zone of newbuild area De Aker in Amsterdam, are eighteen so-called water-dwellings. These are distributed in twos over nine blocks, which have been plugged by means of concrete plinths into a dike specially created for the homes. Through the use of the narrow plinths, a minimal surface area (a third of the whole) has been taken away from the water and thus from nature. The grass roofs return more space to the birds and insects which come to live in the ecological zone than the plinths take away. Due to the high elevation of the floors above the water, there remains sufficient light and air so as not to disturb the biotope. The entire dike is maintained by the association of owner-occupiers – the Municipality of Osdorp provides the maintenance for the green and water structures. Use of the natural surroundings is strictly regulated. As a result, the area is still very attractive – ten years after completion.

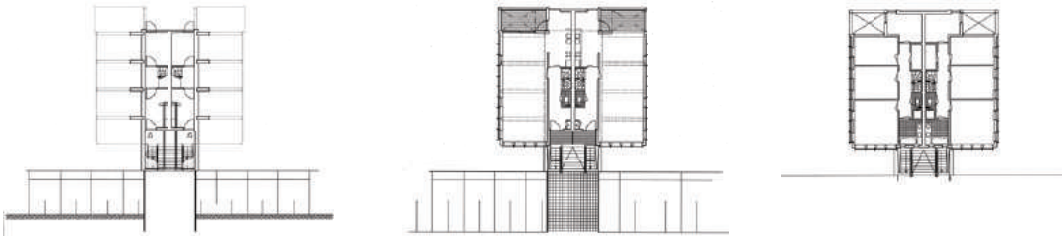
Due to their timber-frame construction, the homes can be laid out flexibly. The use of wood and concrete for the homes, as well as utilization of their position in relation to the sun, make them extremely energy-efficient. As a result, the south facade is almost entirely unobstructed and provided with a conservatory, whilst the north facade is virtually closed off. The exterior space consists of a terrace at the residential level, and a platform at the water level. The terraces coupled to the living rooms can be converted into conservatories; most rooms would then adjoin this conservatory and in the winter could get their fresh air from air that has been pre-heated by the sun. The platforms of the adjacent homes are separated by a reed collar that comes up in summer (use period) and disappears again in winter.

The sustainability balance at the level of the city is good – but not perfect. The location at the city boundary is good, but the limited density of De Aker is less satisfactory.
At the level of the building, the maximum result has not been achieved – because conservatories are optional and not automatically included, these have up to now not been used. This represents a missed opportunity substantially to improve energy efficiency.

conclusion: **balance space** +- **balance building** +

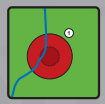


concept project and context; spatial connection of houses with dike and water



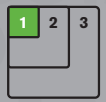
floor plans basement | ground floor | 1st floor

LOCATION CITY BOUNDARY



LEVEL OF SCALE BLOCK | ENSEMBLE

SUSTAINABILITY DIMENSION



SUSTAINABILITY FACILITIES

harmonization within the context,

environmental friendliness,

use of materials,

energy use,

green roof,

heating through passive solar building design,

unlimited flexibility of deployment,

account taken of eventual demolition

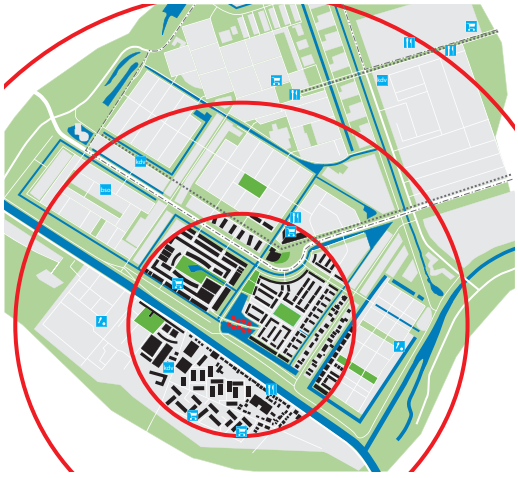
ACCESSIBILITY

location in relation to city

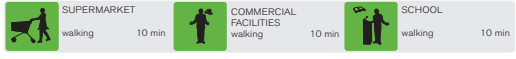
CYCLING		
city centre	35 min	
station Lelylaan	15 min	
bus stop	2 min	
PUBLIC TRANSPORT		
city centre	40 min	
station Lelylaan	20 min	
CAR		
city centre	25 min	
station Lelylaan	10 min	
highway exit	4 min	

Does the project reduce motorized transport?

location in relation to district original situation



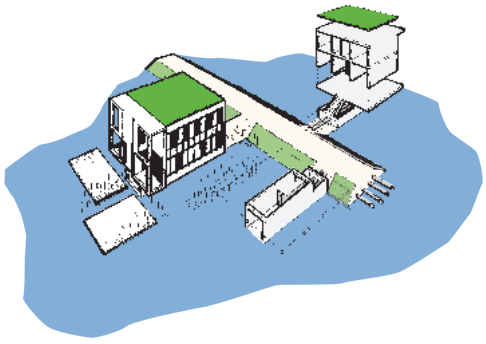
location in relation to district new situation



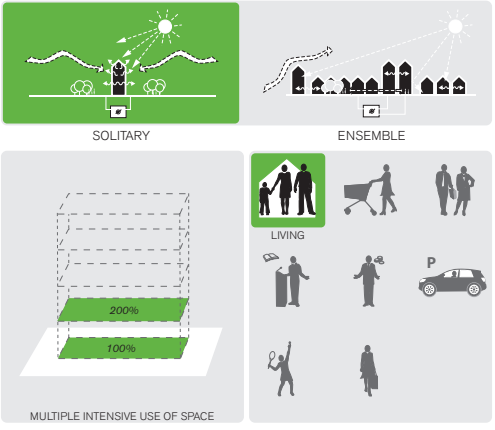
Does the project use new space?

Are the exisiting facilities sufficient?

LOCATION-SPECIFIC CHARACTERISITICS, GREEN AND WATER STRUCTURES



COMPACTNESS, DENSITY AND MIX OF FUNCTIONS



Does the project strengthen specific local characteristics?

++

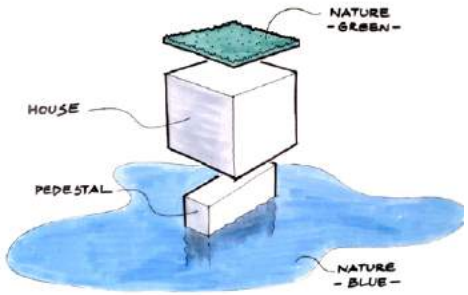
Does the the project respect the green/ blue order?

++

Compactness, density and mix of functions

-+

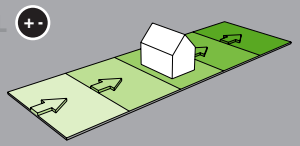
USE OF ENERGY AND MATERIAL AT BUILDING LEVEL



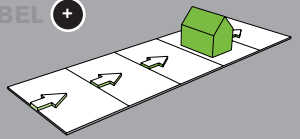
Use of energy and materials of building and process

BALANCE

SPACE-LABEL



BUILDING-LABEL



OVERVIEW SUSTAINABILITY ASSESSMENT

Does the project reduce motorized transport?

Does the project use new space?

Are the existing facilities sufficient?

Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions

Use of energy and materials of building and process

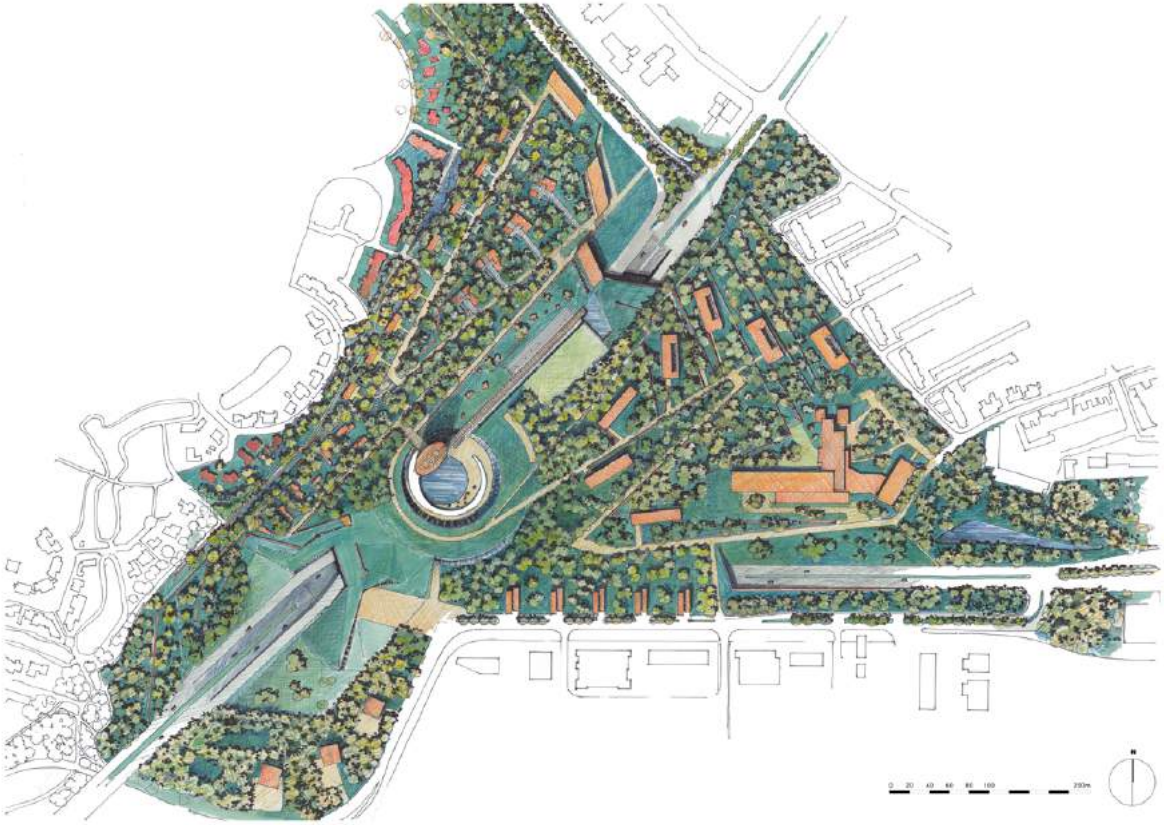
PARK LAAR TILBURG

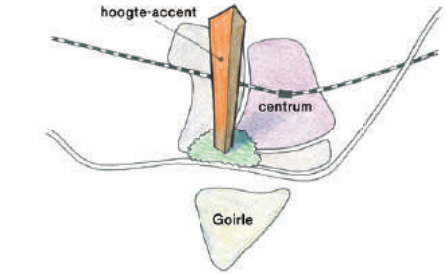
commissioned by Triborgh Bouwontwikkeling, Dura Vermeer Infra in cooperation with Advin infra
short description transformation of traffic junction into a green residential area
status study, 2007

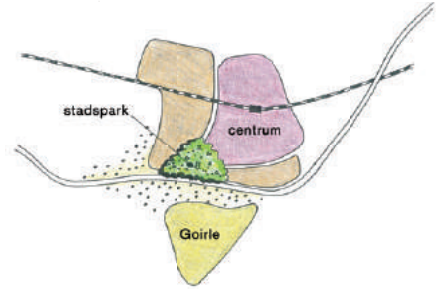
The city of Tilburg is in need of expansion locations. Located on the city's south side and almost 40 hectares in size, the 'Het Laar' area, presently used only as a point of access, has become the object of a study into its possible uses. Three main visions, which do not presently appear reconcilable with one another, are involved: the addition of as large a program as possible for residence and other functions, increasing traffic capacity and the addition of both green structures and a height accent (this in conformity with the existing high-rise vision).

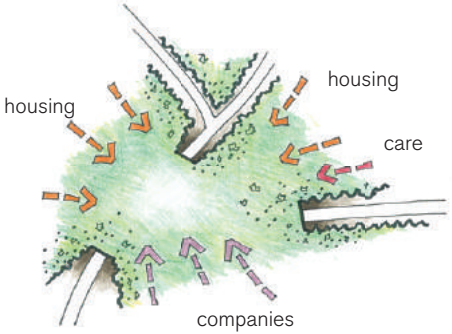
The solution is surprisingly simple: the access roads are optimized (e.g., employing a super-roundabout at the area's midpoint), but recessed. The earth thus excavated is used to elevate the area sufficiently to vault-over the roads with a primarily green 'carpet.' In this way, the harmful effects of the unavoidable automobile traffic are eliminated in one step. The roundabout is the location of the functional focal point: a park & ride (for transferring from car to bus), a bus station, a large supermarket and the desired prominent tower. The rest of the newly reclaimed area can be parceled out, in an unforced manner, for primarily land-based residential buildings. Through the stacking of functions a large number of sustainability facilities becomes possible. At the edges, where the roads disappear under the green carpet, ideal opportunities are located for a distinctive municipal facility (e.g., a 'Tilburg museum'). The great benefit from this solution is that, with it, not only more than 150,000 m2 of high-quality and sustainable residential and work facilities can be realized – but, as well, a 38-ha high-quality park at the same location. The plan has only winners. It represents an exemplary densification within the boundaries of the existing city and creates the ideal point of departure for a high-quality, sustainable, cost-effective new program.

conclusion: **balance space** ++ **balance building** ++


0 20 40 60 80 100 200m
N







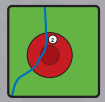
concept sketches | densification linked to surrounding neighbourhoods, urban park, height accent

Energy in Park Laar At Park Laar, sustainable, economically viable and socially respected energy consumption is imported in the longer term by producing renewable energy for own use and to third parties. This is accomplished by the creation of an energy company 't Laar. The potential applications for power generation include bioenergy (biomass, fermentation of biodegradable waste from growers), bio-oil (purchase combination), heat pumps, Geothermal Heat Cold Storage (UTES), Wind energy, Solar energy and cogeneration.

The Underground Waste Transport System (OAT) is a transport of waste from the user to the terminal, a central place where the waste comes together in containers. Advantages of this system, reducing transport movements, reducing CO2 emissions, great freedom in designing the urban environment.

aerial photograph of existing situation

LOCATION CITY-CENTER TRAFFIC JUNCTION



LEVEL OF SCALE URBAN DESIGN

SUSTAINABILITY DIMENSION

SUSTAINABILITY FACILITIES

sustainable urban design

sustainable traffic solution

two-fold land use

combined functions

addition of a building program in combination with a high-quality green structure

energy balance

reuse of waste heat

creating requirements for sustainable buildings

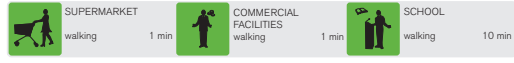
ACCESSIBILITY

location in relation to city

Does the project reduce motorized transport?

location in relation to district original situation

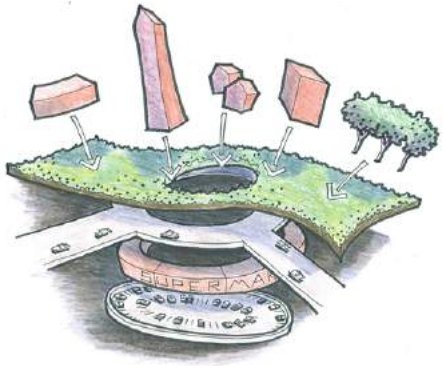
location in relation to district new situation



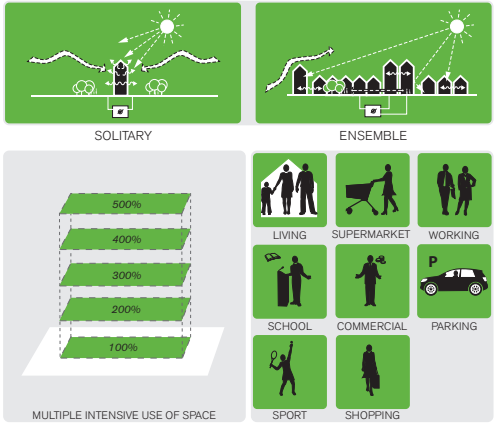
Does the project use new space?

Are the exisiting facilities sufficient?

LOCATION-SPECIFIC CHARACTERISITICS, GREEN AND WATER STRUCTURES



COMPACTNESS, DENSITY AND MIX OF FUNCTIONS

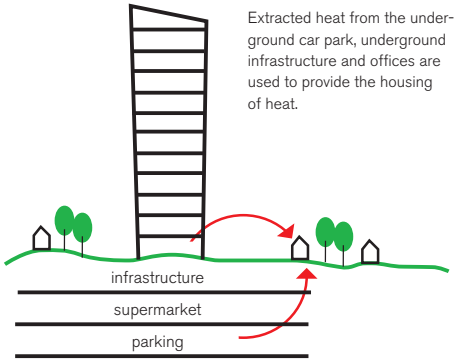


Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions

USE OF ENERGY AND MATERIAL AT BUILDING LEVEL

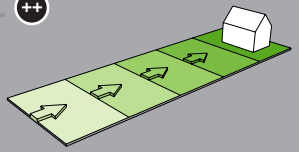


Extracted heat from the underground car park, underground infrastructure and offices are used to provide the housing of heat.

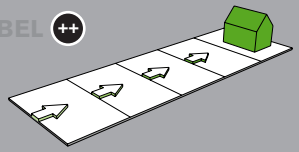
Use of energy and materials of building and process

BALANCE

SPACE-LABEL ++



BUILDING-LABEL ++



OVERVIEW SUSTAINABILITY ASSESSMENT

Does the project reduce motorized transport?

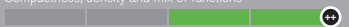
Does the project use new space?

Are the existing facilities sufficient?

Does the project strengthen specific local characteristics?

Does the the project respect the green/ blue order?

Compactness, density and mix of functions



Use of energy and materials of building and process

APPENDICES

photo: blinkfotografie

TANGRAM

Winning Europan 1 (1988-1989) - a bi-annual European design competition for young architects - with a daring design for flexible living in The Hague, was the starting point of TANGRAM. At the office now work around 15 members of staff, led by Charlotte ten Dijke and Bart Mispelblom Beyer.

TANGRAM consistently explores the possibilities and consequences of compaction, both in theory and in practice. Sustainable building in high densities, the only way to keep up with the constant need for quality space in the Netherlands, while preserving the valuable green landscape. Building in a higher intensity makes it possible to preserve the, what is left, open space in the country and around the cities, which is necessary to continue to function properly. In this way the contrasts, the built and open spaces, their qualities, are retained, so necessary for a pleasant living environment.

The challenge for architects and urban planners for the coming years will mainly consist in finding new creative spatial solutions - both in urban and rural environment. It is of utmost importance to develop new urban qualities and new forms of sustainable use of the existing (urban) landscape to apply.


overgang stedenbouw & architectuur
verdichting
stedenbouw
onderzoek
ontwerp & uitvoering
architectuur
publicaties en tentoonstellingen
combinatie projecten
woningen
utiliteitsbouw
advisering
BNA
NGO's
VROM
Rijksbouwmeester

WORKING STAGE

TANGRAM has extensive expertise in both urban planning and architecture. The combination of both scale areas and fields of expertise, stems from the belief that the best solutions to questions of planning in the urban context are at the interface of urban planning and architecture. Extensive experience is gained in developing plans for complex sites, taking into account existing circumstances, residents participation, integrated thinking with regard to public space, sustainability, infrastructure and buildings. With a questioning mind it always leads to sitespecific plans. Clients include municipalities and developers, corporations and private clients.

This questioning setting led also to a new addition to their office: TANGRAM research.

Major clients for research projects are several municipalities (such as Utrecht, Groningen, The Hague, Almelo) and the Central Government (Ministry of Housing, Spatial Planning and the Environment VROM and the Government Buildings Agency). TANGRAM also cooperates closely with NGOs such as the Foundation for Nature and the Environment.

NOTES

1 Koenen, M.J./Endepols, J.: Verklarend woordenboek der Nederlandse taal; tevens vreemde-woordentolk; 27th edition, Wolters-Noordhoff nv, Groningen, 1969, p 256

2 http://nl.wikipedia.org/wiki/Sustainable; According to Wikipedia, the concept of sustainability is rooted in ecology. Sustainable development was a key concept in the UN report 'Our common future' published in 1987 (also known as the Brundtland report). The report draws a clear connection between economic, ecological, and social aspects. It argues that poverty forms an obstacle to the sustainable use of the natural environment and therefore hinders the balance between these aspects.

3 The Club of Rome was set up in 1968. The goal of the group is to examine the quantitative and qualitative connections between global problems (population growth, food production, industrialization, exhaustion of natural resources, pollution, etc), to point out the seriousness of the problems to the world, and to stimulate politicians to take measures to change the situation.

4 In 1972 Dennis Meadows wrote the report 'The Limits to growth: a global challenge' for the Club of Rome. Based on the growth figures at the time, the study predicted a future scenario and concluded that industrial development would lead to the exhaustion of natural resources within the foreseeable future, a consequence of which would be a decline in the size of the world's population owing to deteriorating food supplies and healthcare.

5 Cradle tot cradle: remaking the way we make things, Michael Braungart/ William McDonough, North Point Press, New York, 2002; the vision presented in the book is an appeal for the development and design of products on the basis of safe and fully biodegradable raw materials. In that way, infinite cycles of biological and artificial materials can be created.

6 De Almere Principles, 2008 – the city of Almere considers ecology and sustainability to be the key themes in the large-scale developments to double the size of the city between now and 2030. This

book summarizes the effects in the domains of economy, ecology, and society.

7 Staatsbosbeheer: (www.staatsbosbeheer.nl/Doorlees/Winkel/Hout.aspx): The Netherlands consumes c. 16 million cubic metres of wood per year for, among other things, house construction, paper, and packaging materials. A production forest twice the size of the Netherlands is required for this amount of timber. The majority of our wood therefore comes from abroad. Dutch forests meet about seven percent of our wood needs.

Probos: (http://www.probos.net/bosdigitaal/html/doc_houtproductie_txt.html:

Because the Netherlands is more and more an urban society, it can supply just 10% of its wood needs. The degree to which the Netherlands depends on other countries for its wood supplies is illustrated by a spatial crop of 5.4 million hectares in the moderate climate zones and 1.1 million hectares in the tropics. That means that twice the surface area of the entire Netherlands is maintained elsewhere to meet the wood needs of the country.

8 'VINEX'is the abbreviation for Fourth Memorandum on Physical Planning Extra (original title: Vierde Nota Ruimtelijke Ordening Extra) , a policy of the Dutch Ministry of Housing from 1991. This note, a sequel to the 1988 Fourth spatial planning memorandum, provides principles for the construction of new housing sites for the period from January 1, 1995.

To accommodate further population of the Netherlands the VINEX document were a set of principles for the construction of new residential areas at that point. The main point was that new housing should be planned near existing urban centers. This would contribute to the strengthening of existing shopping centers and facilities, reducing the threat of exodus of (medium) large cities in the Netherlands, protection of open areas in the Netherlands by concentration of urbanization around the (medium) large cities, restricting car use between home, work and facilities (short distances should offer more opportunities for public transport, cycling and walking) source: wikipedia;

At this moment there are serious doubts whether these intended effects have become true - often it seems to be rather the opposite, causing major discussions about the result of this policy. See e.g.: Wendy Bohte: "Residential self selection and travel. The relationship between travel-related attitudes, built environment characteristics an travel behaviour."

9 Newman and Kenworthy, 1989; http://maps.grida.no/go/graphic/urban-density-and-transport-related-energy-consumption (original source: Atlas Environnement du Monde Diplomatique 2007)

10 ABF Research: Housing Market Outlook, Socrates 2010, August 2010, commissioned by Ministry of Environment, Directorate General for Housing, Communities and Integration (now the Ministry of Internal Affairs, Directorate General for Housing, and Neighborhood and Integration).
This study is a forecast for the development of housing stock in the Netherlands between 2008 and 2020. Starting point is that the number of households is expected to grow by 50,000 per year. It is further noted that the income expectations were revised substantially by influence of the recent economical crisis. Although it does not lead to changes in longterm housing needs, people tend to postpone plans to move or buy a house. Within these constraints, the study predicts a total growth of 656,000 homes in the period 2008-2020. Between 2020-2030 the expected growth is still 352,000 dwellings. The growth is mainly owner occupied. Obviously there are big regional differences.

11 Köhne, Hans, Duurzaamheid meetbaar? Cement magazine (theme issue), 3/2009, p 22-25, Article that compares 50 instruments to make sustainability measurable: Energy Performance Standardization (EPN/EPC), Energy Label (EPA), Toolkit for sustainable housing construction, GPR-building, GreenCalc+, BreeamNL; for further information, see website addresses in reading list

12 www.dearchitect.nl, 'Common language on sustainability' – article about the development of a common assessment system by various advisors and with support from the Ministry of Housing, Spatial Planning and the Environment in which the same terms and calculation methods are deployed to highlight and evaluate the same concepts and situations.

13 Maas, Lolanda: doctoral research into 'Vitamin G', 2009, VU University Amsterdam; study of the relation between green surroundings and health; green surroundings enable people to recover more rapidly from stress, and support movement and social contacts.

14 Maas, Jolanda: doctoral research 'Vitamin G', see earlier note.

15 Splendid Compact NL, a study about increasing inner-city density, written by Tangram Architekten in collaboration with Rudy Uytenhaak and commissioned by the Board of Government Advisors and the Ministry of Housing, Spatial Planning and the Environment; officially presented in January 2010

BIBLIOGRAPHY

books

Arts, P., Ebregt, J., Eijgenraam, C., Stoffers, M., Bedrijfslocatiemonitor; de vraag naar ruimte voor economische activiteit tot 2040. Den Haag, Centraal Planbureau, 2005

Atzema, O., On the conceptualization of agglomeration economies: The case of new firm formation in the Dutch ICT sector'. The annals of Regional Science, vol. 38, pp. 263290, 2004

Atelier Rijksbouwmeester, Maak het verschil. Agenda van Rijksadviseurs 2009-2012. Den Haag, 2009

Baart, T., Atlas van de verandering. NAi Uitgevers Rotterdam, 2000

Bakker, J.H., Welkom in Megapolis. Denken over wonen, stad en toekomst. Atlas, Amsterdam, 2008

Beleving en waardering van nieuwbouwwijken. Ruimtemonitor. Planbureau voor de leefomgeving, Den Haag, 2002

Berghauser Pont, M.Y., & Haupt, P.A., Spacemate. The spatial logic of urban density. Delft: DUP Science, 2004

Besselaar, P. van den, 'Technologie, Sociale Structuur, Werkgelegenheid'. In: R. Weehuizen, Toekomst@werk.nl Reflecties op Economie,Technologie en Arbeid. Den Haag, Stichting Toekomstbeeld der Techniek, 2000, pp. 144159

Besselaar, P. van den, 'The future of employment in the information society, a comparative and multilevel study'. Journal of Information Science 23 (1997) pp 373-392

Bezemer, V., Daalder R., Groen. The urban power. In opdracht van de DRO Amsterdam, 1998

Boeijenga, J., Mensink J., VINEX Atlas. Uitgeverij 010 Rotterdam, 2008

Bouwens, C., SEV Realisatie, Dullemen, K. van (red.), Met groen meer stad. Nieuwe impulsen voor stedelijk groen. VROM, Den Haag, 2006

Boven, J. (red.) Na de sloop. Nicis Institute, Den Haag, 2008

Braungart, Michael / McDonough, William: Cradle tot cradle: remaking the way we make things, North Point Press, New York, 2002; Nederlandse editie: Cradle tot cradle - afval = voedsel, vertaling: Search Knowlegde b.v., Heeswijk, 2007

Broek, L. van den, Jong, A. de, Duin, C. van (CBS), Huis, M. van (CBS), Boschman, S., Agtmaal-

Wobma, E. van (CBS), Regionale bevolkings-,allochtonen- en huishoudensprognoses 2007-2025. Planbureau voor de leefomgeving, Den Haag 2008

Brosens, M. en Woestenburg, M., De waarde van het Groen. Groen en de stad. Den Haag, 2008

Bruinsma, F., Dijk, J. van, Gorter, C., Mobiliteit en beleid. Koninklijke van Gorcum, Assen, 2001

Dam, F., Bijlsma, L., Leewen, M. van, Pálsdóttir, H., De Land-Stad. Landelijk wonen in de Netwerkstad. NAi Uitgevers, Rotterdam, Ruimtelijk Planbureau Den Haag, 2005

Delta Commissie (red.), Samen werken met water. Een land dat leeft bouwt aan zijn toekomst. Bevindingen van de Delta Commissie, Den Haag, 2008

Derks, W., P. Hovens en L. Klinkers, De krimpende stad. NICIS, Den Haag, 2006

Dijke ten, C., Mispelblom Beyer, B., Klooster, I. van, 'Massa: leegte als centraal ontwerpthema'. Archis juni, Rotterdam, 2003

Dijke ten, C. en Mispelblom Beyer, B., 'Mooi dicht is niet lelijk! Slopen voor het goede doel'. Stadcahiers, 3/2007, p.84-91, Tracity, Haarlem, 2007

Dijke ten, C. en Mispelblom Beyer, B., 'Ruimte scheppen door verdichting'. Nova terra, mei 2007, Den Haag, 2007

Duivesteijn, A., 'Vrije ruimte voor de toekomst', Bouw, april 1998, FSI-GSI-OSR als instrumentarium voor verdichting en verdunning (SPACEMATE),

DRO, Amsterdam, 2003, Gadet, J. en zaanen van, K., Succesvolle vestigingsplekken. Plan Amsterdam 32006,

DRO, Amsterdam, 2006, Gadet, J., Smeets, H., Het Grote Groenonderzoek. Plan Amsterdam 3-2009,

DRO, Amsterdam 2009, Gemeente Amsterdam, Ontwerp Structuurvisie Amsterdam 2040. Amsterdam, 2009

Feddes, Fred (red), De Almere Principles: Voor een ecologisch, sociaal en economisch duurzame toekomst van Almere 2030, Thoth, Bussum, 2008

Gemeente Den Haag, Agenda voor de Haagse verdichting. Concept, Den Haag, 2008

Gemeente Rotterdam, Stadsvisie Rotterdam. Ruimtelijke ontwikkelingsstrategie 2030. Concept, januari 2007

Graaf, K. de (red.), Ruimte maken voor krimp. BNA, Amsterdam, 2009

Gorter, J. en Kok, S., Agglomeration Economies in the Netherlands. CPB, Den Haag, 2009

Hagedoorn, C., Lysen, E.,Inventory and analysis of courses on renewable energy & energy efficiency

at Dutch universities Utrecht Centre for Energy research (UCE). Utrecht University, Utrecht, 2005

Hamers D., Nabielek, K., Bloeiende bermen. Verstedelijking langs de snelweg. NAi Uitgevers,Rotterdam, 2006

Harmsen H., Van der Waal GM (red.), De Oude Kaart van Nederland: Leegstand en herbestemming. Atelier Rijksbouwmeester, Den Haag, 2008

Hartman, W., De Vloeibare stad. Architectura & Natura, Amsterdam, 2007

Het balkon. Buitenruimten in de stad. Uitgave van de Zuiderkerk en Ymere, Amsterdam, april 2008

Hilten R. van (red.) Utrecht Utopia. BRU, Utrecht, 2001

Hoek, J. van den, Over het ontmoderniseren van de eigentijdse stedenbouw. Archined, Rotterdam, 29 mei 2006

Hof, J. van., 'Stadsuitbreiding voor toekomstige generaties'. City journal: wetenschappelijk tijdschrift voor de steden, NICIS, Den Haag, 2006

Jacobs, J., The death and life of American cities. Random House, New York, 1961

Jenks e.a., Achieving Sustainable Urban Form. E & FN Spon., Londen, 2000

Klunder, G., Sustainable solutions for Dutch housing. Reducing the environmental impacts of new and existing houses. Delft University Press, Delft, 2005

Köhne, ing. Hans, Duurzaamheid meetbaar? Cement (thema), 3/2009, p 22-25

Koenen, M.J./Endepols, J.: Verklarend woordenboek der Nederlandse taal; tevens vreemde-woorden-tolk; 27e druk, Wolters-Noordhoff nv, Groningen, 1969

Kreutzberger, E., Benders, G., Bruijn, N. de (red.) VELOV. Verdichten langs openbaar vervoer in stadsgewest en regio Haaglanden. Den Haag, 2004

Latten, J. e.a., De nieuwste groei heet krimp. Een perspectief voor Parkstad Limburg. NICIS, Den Haag, 2009

Latten, J., 'Veranderd demografisch tij'. Demos, bulletin over bevolking en samenleving 25, Den Haag, p. 46.

Leidelmeijer K., Kamp I. van, Kwaliteit van de leefomgeving en leefbaarheid; Naar een begrip-penkader en conceptuele inkadering. RIGO, Amsterdam, 2003.

Maas, Jolanda: Vitamine G: Green environments - Healthy environments, promotieonderzoek februari 2009, Nivel, Vrije Universiteit Amsterdam, 2009

Mak, John/ Roth, Ester, GPR Gebouw: uniforme criteria voor duurzaam bouwen, Architectuur &

Stedenbouw, 2007, p 22-23

Meadows, Dennis (Club of Rome): 'grenzen aan de groei', originele titel: "The Limits to growth: a global challenge",1972

Must, Stedelijk Amsterdam. In opdracht van Kamer van Koophandel Amsterdam, Amsterdam, 2009

Meten met twee maten. Referentieplannen bebouwingsintensiteit. DRO, Amsterdam, 2001

Meten met twee maten. Een zoektocht naar het meetbaar maken van het begrip 'optimaal ruimtegebruik'. DRO, Amsterdam, 1999

NIROV, De nieuwe kaart van Nederland. Den Haag, 2007heden, www.nieuwekaart.nl

Newman, P.W.G., Kenworthy, J.R., Gasoline consumption and cities—a comparison of U.S. cities with a global survey and some implications. Murdoch University, Murdoch, WA, USA, 1987

Newman, Peter/ Kenworthy, Jeffrey: Cities and Automobile Dependence: An International Source-book, Gower, Aldershot, 1989

Newman, Peter/ Kenworthy, Jeffrey: Sustainability and Cities: Overcoming Autmobile Dependence, Island Press, Washington DC, 1999

OCW, VROM, Ez, LNV, V&W, Defensie en BzK, Actieprogramma Ruimte en Cultuur. Den Haag, 2005

Oort, F. van, 2002,' Innovation and agglomeration economies in the Netherlands'. Tijdschrift voor Economische en Sociale Geografie, vol.93, nr. 3, pp. 344-360.

Overdijk, C., 'Hoogstedelijk zonder te stapelen', Binnenlands Bestuur, Den Haag, mei 2009

Rapport Locatiekeuzes bij woningbouw: Eindrapportage van de werkgroep Verstedelijking. Den Haag, 2004

Renes, G., Weterings, A., Gordijn, H., De toekomst van bedrijventerreinen: van uitbreiding naar her-structurering. De Maasstad, Rotterdam, 2009

RIGO research en advies, Vinex door de ogen van bewoners. Amsterdam,1999

RIGO research en advies, Verstedelijking Randstad na 2010 gebiedsverkenning. Amsterdam, 2002

RIGO Research en advies, Nieuwbouw en herstructurering. Doorstroom en Dynamiek in nieuwe en oude wijken. In opdracht van Ministerie VROM, Amsterdam, 2003

RIGO research en advies, Monitor woningbouwcapaciteit Noord-Holland. Amsterdam, 2006

RIGO research en Advies BV, De ruimte voor woningbouw binnen het bestaand bebouwd gebied. Een onderzoek naar de regionale ruimte voor binnenstedelijk bouwen. In opdracht van Ministerie VROM, Amsterdam, 2008

RIGO research en Advies BV + OTB Delft, Evaluatie van verstedelijking VINEX 1995 tot 2005. In opdracht van Ministerie VROM, Amsterdam, 2007

Ritsema van Eck, J., Amsterdam, H. van, Schuit, J. van der, Ruimtelijke ontwikkelingen in het stedelijk gebied; dynamiek stedelijke milieus 2000-2006. Den Haag Bilthoven, PBL, 2009

RIVM, Leefomgevingsbalans. Voorzet voor vorm en inhoud. RIVM, Bilthoven,1998

RMB (Raad voor het milieubeheer) en RRO (Raad voor de Ruimtelijke Ordening), Gezamenlijk Advies, Duurzaam en leefbaar: over de onderlinge afstemming van ruimtelijk beleid en milieubeleid. RMB, Den Haag, 1996

Rogers, Richard/ Gumuchdijan, Philip: Cities for a small planet, Faber and Faber Ltd, London, 1997

Ruimte maken voor krimp. Ontwerpen voor minder mensen. BNA, Amsterdam, 2009

Ruimtebehoefte van recreatie, water, natuur, infrastructuur en landbouw. LNV, Den Haag, januari 2002

Ruimtelijk Planbureau, Krimp en ruimte: bevolkingsafname, ruimtelijke gevolgen en beleid. Rotterdam, NAi Uitgevers, Rotterdam, 2006

Samenvatting Nota Mensen,Wensen, Wonen, wonen in de 21e eeuw. VROM, Den Haag, november 2000

Schoonbeek, R., Liesker, B., Ploeg, J. van der, De tuinstad is dood; leve de tuinstad! Herstructurering van de naoorlogse stad als culturele ontwerpopgave.

STAWON/ NAi uiScott, A., The cultural economy of cities: essays on the geography of image-producing industries. Sage, London, 2000

Stutz, B., Analysis The New Urbanists: Tackling Europe's Sprawl.Yale, http://e360. yale.edu/, 2009

Stapelen en voegen. Onderzoek naar efficiënter grondgebruik. DRO, Amsterdam,1997

Tillie N., Dobbelsteen A. van den, Doepel D., Jager W. de, Joubert M. & Mayenburg D., REAP, De Rotterdamse

Energie Aanpak en Planning. REAP – Rotterdam Energy, Approach & Planning, Rotterdam Climate Initiative, Rotterdam, 2009

Thesing, S., Stapeling en integratie van voorzieningenaccomodaties. DRO, Amsterdam, 2002

Thomsen, A., 'De waarde van het bestaande, 10 redenen voor renovatie', in: Stad sta stil. VIBA, Den Bosch

TU Delft, Stedelijk wonen, een brug tussen wens en werkelijkheid. Concept, Delft, 2008

Urban Unlimited Rotterdam i.o.v. Provincie zuid Holland, Verdichting Zuidvleugel. Stadt Land Fluss, Berlijn, 2003

Uytenhaak, R., Explosie van de stad', Steden vol ruimte. Uitgeverij 010, Rotterdam, 2008

Verdonk, N. (concept), Dehaene, M. (tekst), Jansen, B. (red.), De intense stad : verdichting en functiemenging in Groningen. Groningen, 2004;
opgevolgd door Intense laagbouw, 2009

VROM, StiR, 65x intensief ruimtegebruik. Voorbeeldprojecten intensief Ruimtegebruik. Den Haag, 1998

VROM, StiR, Meer doen met dezelfde ruimte. 28 voorbeelden van intensief Ruimtegebruik. Den Haag, 1999

VROM, StiR, Meer doen met dezelfde ruimte. 28 voorbeelden van intensief Ruimtegebruik. Den Haag, 2000

VROM, De kansen van de ondergrond. Mogelijkheden, voordelen en instrumenten. Den Haag, 2006

VROM, Nota Ruimte – Ruimte voor ontwikkeling / deel 4. Den Haag, 2006

VROM, Oude gebieden, nieuwe functies. Den Haag, 2007

VROM, Samenvatting Verbeteren kwaliteit leefomgeving. Den Haag, 2007

VROM, Zoeken naar ruimtewinst. Handreiking ruimtewinst in bebouwd gebied. Den Haag, 2004

VROM/LNV, Handreiking kwaliteit landschap. Den Haag, 2006

Waals, J.F.M., De milieu-effecten van verstedelijking. RIVM, Bilthoven, mei 1997

Wisselink, W., Let op! kwaliteit. Ontwikkelingsbedrijf Vathorst Beheer BV, Amersfoort 2008

Wulp, N.Y. van der, e.a., Belevingswaardenmonitor Nota Ruimte 2006. Nulmeting Landschap naar Gebieden. Milieu- en Natuurplanbureau, Bilthoven
WOtrapport 75, WOT Natuur & Milieu Wageningen UR, Wageningen, 2007

Zandee, R. en Tiemersma, D., Meer bouwen in de stad. Kan dat? 'Eindrapportage van het project 'Compacte stad: Verdichten in een gezonde stad'. Stichting Natuur en Milieu (in opdracht van VROM/WWI), Utrecht, mei 2009

Zandee; R., Resultaten enquête stedelijke regio's. Vervolgrapportage van het project 'Compacte stad: Verdichten in een gezonde stad. Utrecht, juli 2009

websites

www2.nen.nl/nen/servlet/dispatcher.Dispatcher?id=195525

www.almere.nl/de_stad/stadsprojecten/almere_principles

www.breeam.nl/

www.dearchitect.nl/nieuws/2010/01/08/duurzaamheidstaal.html

www.duurzaamheid.nl/c2c/

www.energielabel.nl/

www.gprgebouw.nl

www.staatsbosbeheer.nl

www.probos.net

www.senternovem.nl/epn/

www.toolkitonline.nl/

www.w-e.nl/default.htm?WE_voorbeelden/eco-quantum/eco-quantum.htm~Fr_content

COLOPHON

TANGRAM, architecture and urban landscape

Cronenburg 150

1081 CN Amsterdam

the Netherlands

tel +31 20 676 1755

fax +31 20 676 8737

info@tangramarchitekten.nl

www.tangramarchitekten.nl

april 2011

BALANCE

THE DIMENSIONS OF SUSTAINABLITIY

content and design

TANGRAM

production in collaboration with

Academie of Architecture, Amsterdam, NL

Roger Williams University, Bristol , Rhode Island, USA

with a contribution of

John Lewis Marshall, Amsterdam, NL (photography)