01.01_PH-SUMMER SCHOOL

SOME CONSIDERATIONS

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Language support: William GALLAGHER, Rob McLEOD, Michael WILLIAMS
Date: 2009-07-18

Some Considerations:

1. Why do we build?
2. How do we build?
3. What consequences does this have?
4. How can we build better?
5. How is the current development?
6. How is the development in the field of building?
7. Where do we have to go?
8. Which developments have to be taken into account?
9. What can, what must be the focus, the objective?
10. What can the strategy be?
11. What does that mean for architectural discussion?

Source:

CONSIDERATION NO. 1:

Why do we build?

Source:

Why do we build?

The temperature control system in the human body developed itself in a zone with an annual average temperature of 26 - 28°C

Source: National Geographic Society

Why do we build?

Through the power of the brain to:

- use fire,

- develop clothes and

- construct homes

it has been possible to colonize other unsuitable climates for 90.000 years.

Source: H.P.Willig, pullover.de, Baker Lake Archive

Why do we build?

That means that we have to build climate shelters in these differing regions (as well as possible).

It is the primary function of our buildings to provide these climate shells.

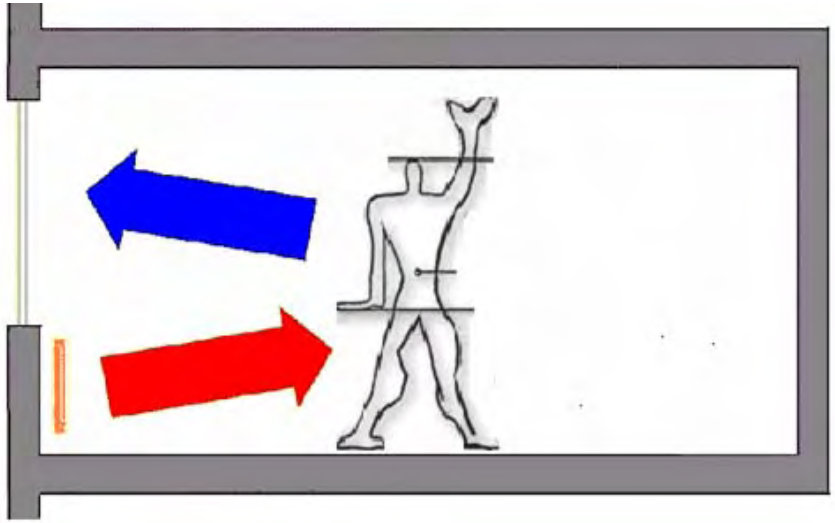
Source:

CONSIDERATION NO. 2:

How do we build ?

How do we build?

Till now, in the „cold“ regions of our world, the building shell could not fulfil the temperature requirements sufficiently.

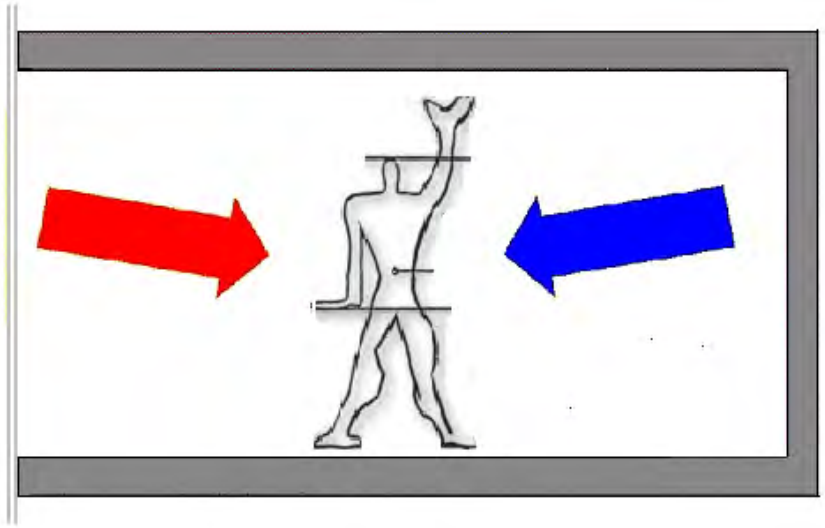


To compensate for this deficiency it was necessary to bring in „heating“ - energy.

Source:

How do we build?

… and „modern“ (?) architecture

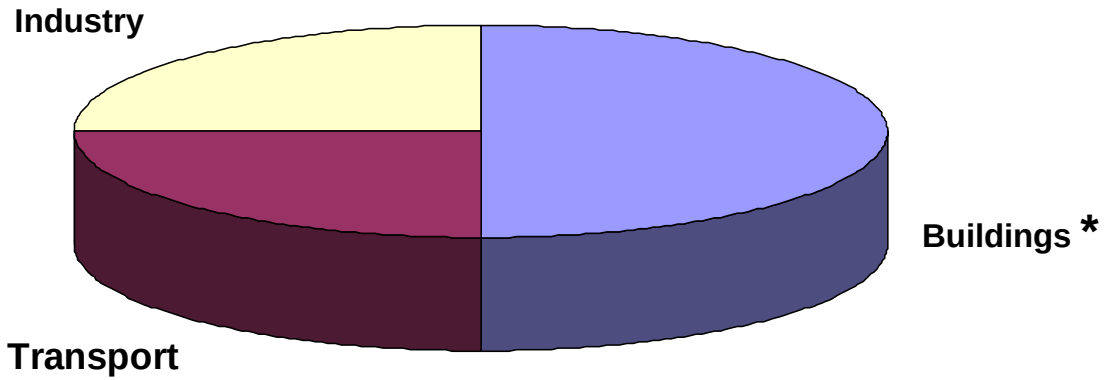


It has become increasingly necessary to add some „cooling“ - energy to compensate for these new deficiencies.

Source:

How do we build?

This „compensation for deficiencies“ uses fully half of the world energy consumption! *



=> high responsibility of all planners and builders !!!

* Heating, cooling, domestic engineering

Source:

CONSIDERATION NO. 3:

Which consequences does this have?

Which consequences does this have?

The complete difficulties in a few key words:

- energy costs, economics, „power“
  - balance of payments
  - dependence on imports
  - political dependence
- emissions, environment
  - CO2, climate change
- building quality, living quality
  - lacking living comfort
  - lacking air hygiene
- local manpower policy

Source:

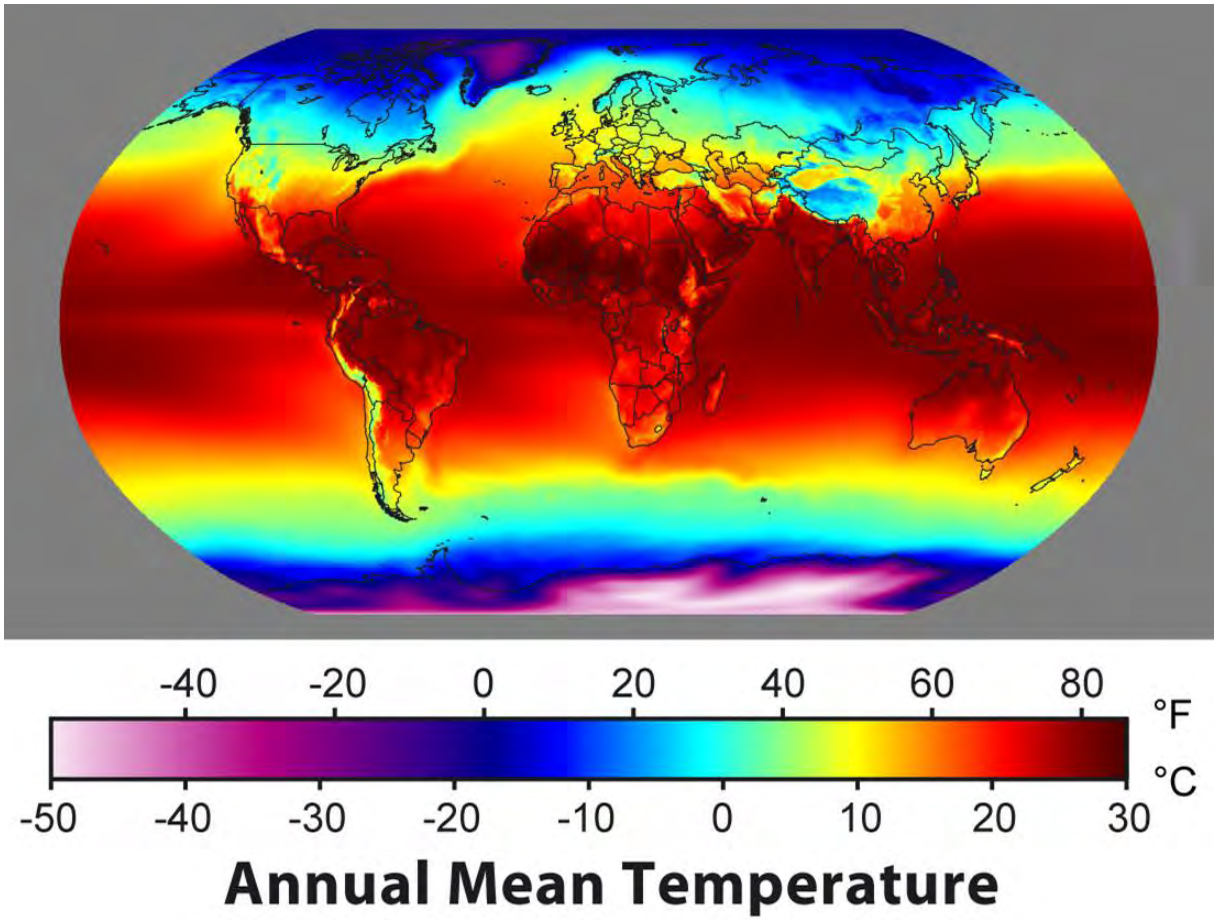
Which consequences does this have?

Some “Spotlights” on Certain Aspects of Climate Change

Source:

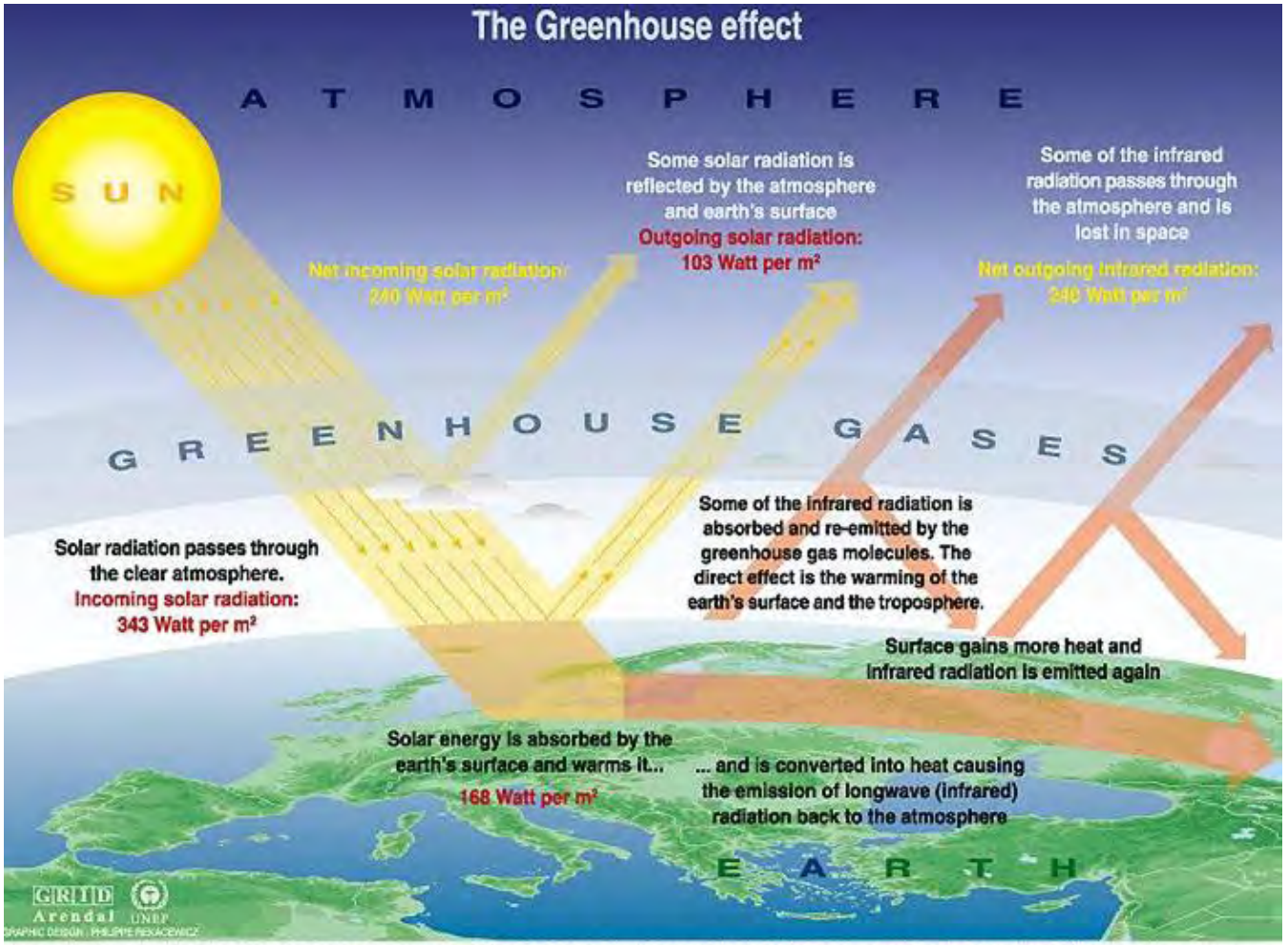
Which consequences does this have?

Aspects of Climate change



Source: http://upload.wikimedia.org/wikipedia/en/a/aa/Annual_Average_Temperature_Map.jpg

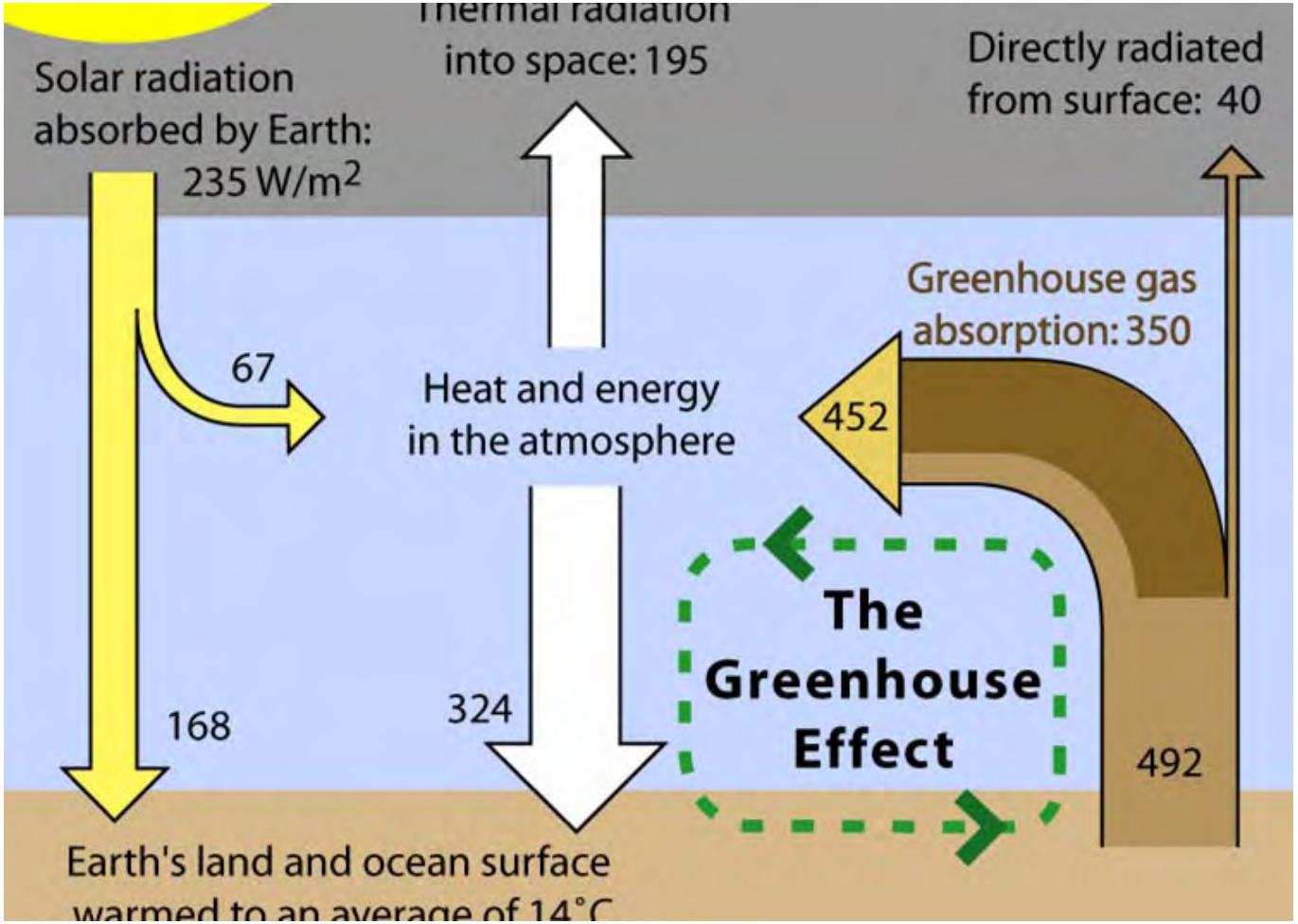
Which consequences does this have?



Sources: Okanagan university college in Canada, Department of geography, University of Oxford, school of geography; United States Environmental Protection Agency (EPA), Washington; Climate change 1995, The science of climate change, contribution of working group 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge university press, 1996.

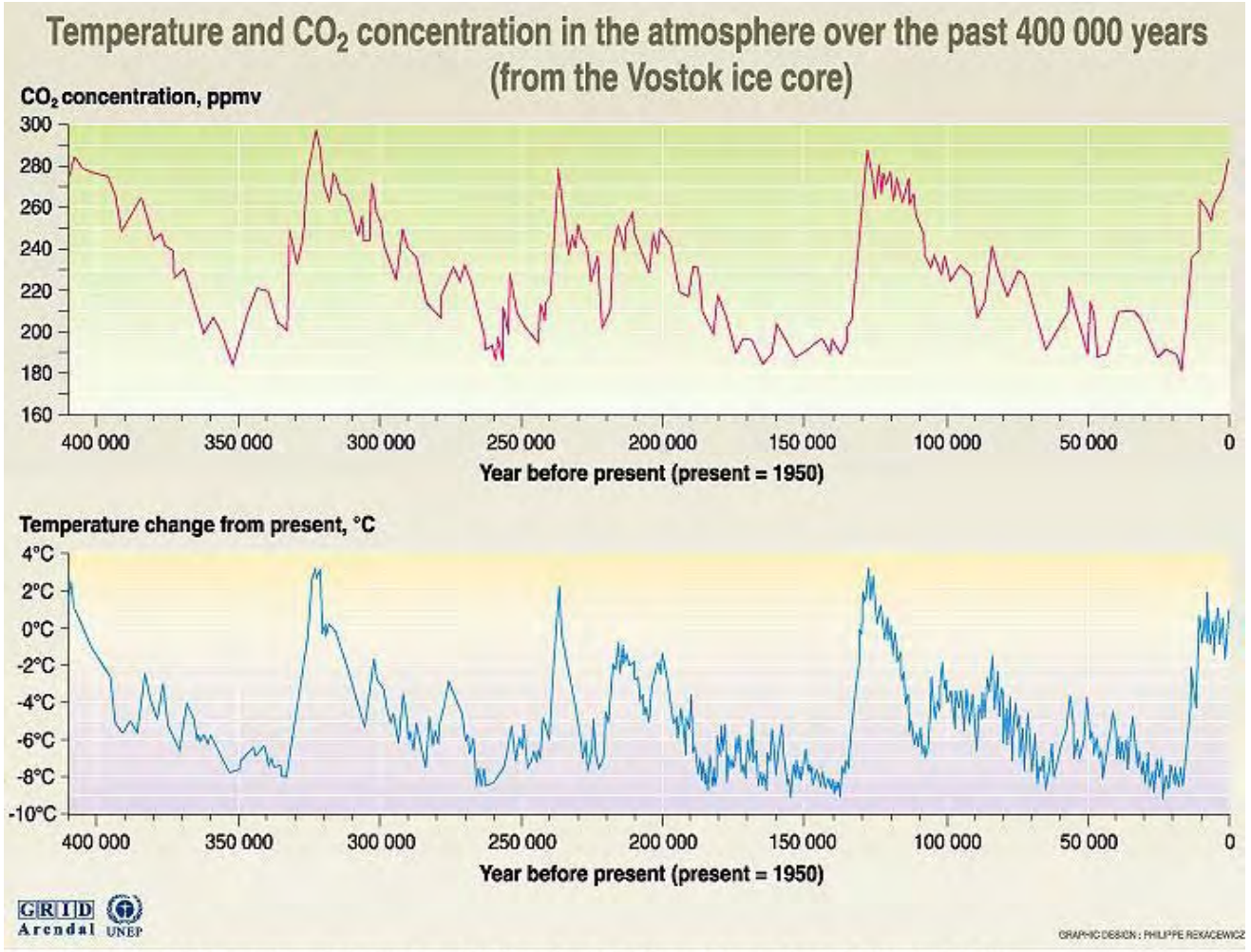
Source: http://www.grida.no/climate/vital/03.htm

Which consequences does this have?



Source: www.globalwarmingart.com/images/2/26/Greenhouse_Effect.png

Which consequences does this have?



Source: J.R. Petit, J. Jouzel, et al. Climate and atmospheric history of the past 420 000 years from the Vostok ice core in Antarctica, Nature 399 (3JUne), pp 429-436, 1999.

Source: www.grida.no/climate/vital/02.htm

Which consequences does this have?

The main greenhouse gases

Greenhouse gases	Chemical formula	Pre-industrial concentration	Concentration in 1994	Atmospheric lifetime (years)***	Anthropogenic sources	Global warming potential (GWP) *
Carbon-dioxide	CO_2	278 000 ppbv	358 000 ppbv	Variable	Fossil fuel combustion Land use conversion Cement production	1
Methane	CH_4	700 ppbv	1721 ppbv	12,2 +/- 3	Fossil fuels Rice paddies Waste dumps Livestock	21 **
Nitrous oxide	N_2O	275 ppbv	311 ppbv	120	Fertilizer industrial processes combustion	310
CFC-12	CCl_2F_2	0	0,503 ppbv	102	Liquid coolants. Foams	6200-7100 ****
HCFC-22	$CHClF_2$	0	0,105 ppbv	12,1	Liquid coolants	1300-1400 ****
Perfluoromethane	CF_4	0	0,070 ppbv	50 000	Production of aluminium	6 500
Sulphur hexa-fluoride	SF_6	0	0,032 ppbv	3 200	Dielectric fluid	23 900

Note : pptv= 1 part per trillion by volume; ppbv= 1 part per billion by volume, ppmv= 1 part per million by volume

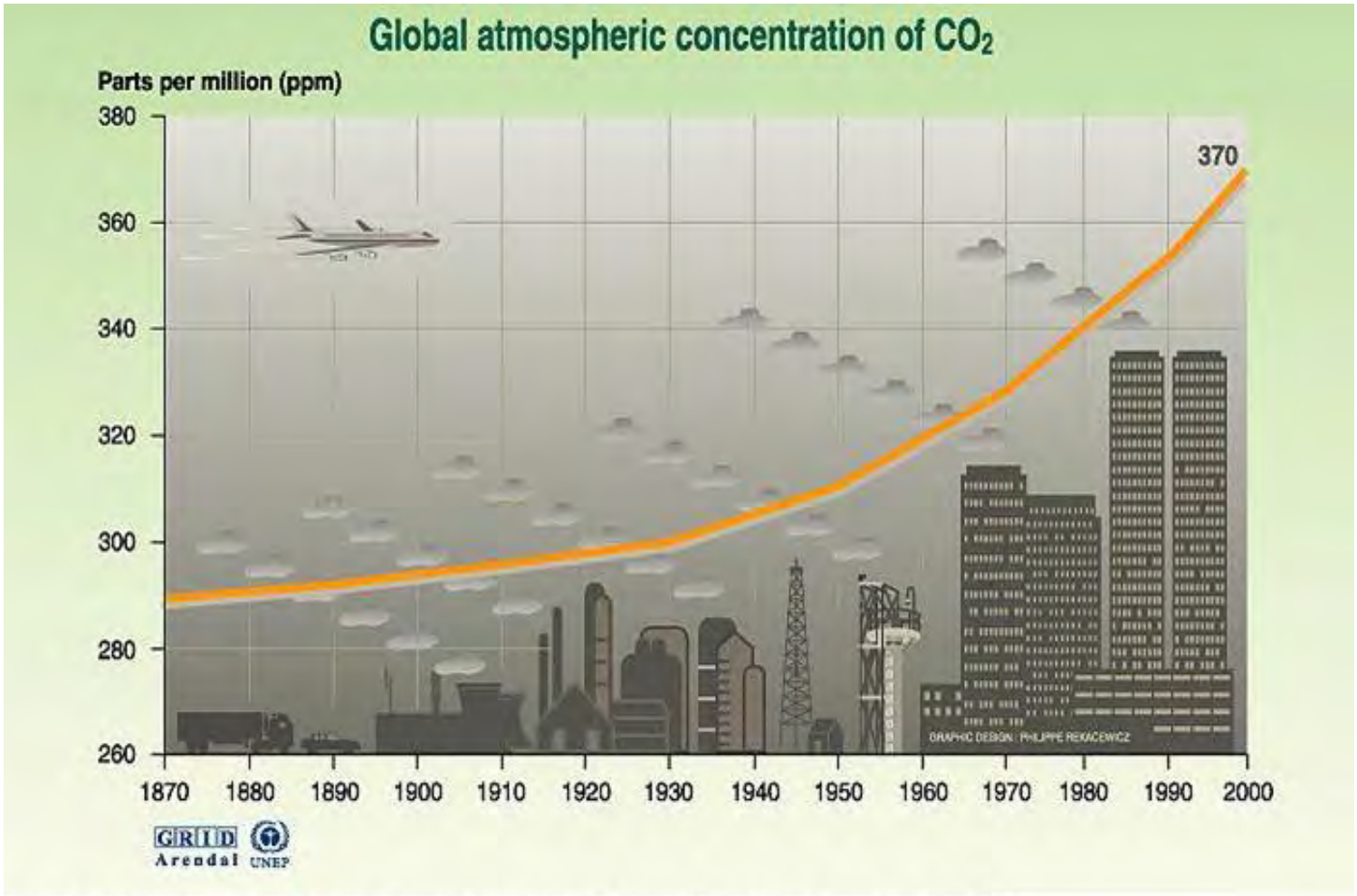
* GWP for 100 year time horizon. ** Includes indirect effects of tropospheric ozone production and stratospheric water vapour production. *** On page 15 of the IPCC SAR. No single lifetime for CO_2 can be defined because of the different rates of uptake by different sink processes. **** Net global warming potential (i.e., including the indirect effect due to ozone depletion).

GRID Arendal UNEP

Source: IPCC radiative forcing report ; Climate change 1995. The science of climate change, contribution of working groups 1 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996

Source: www.grida.no/climate/vital/05.htm

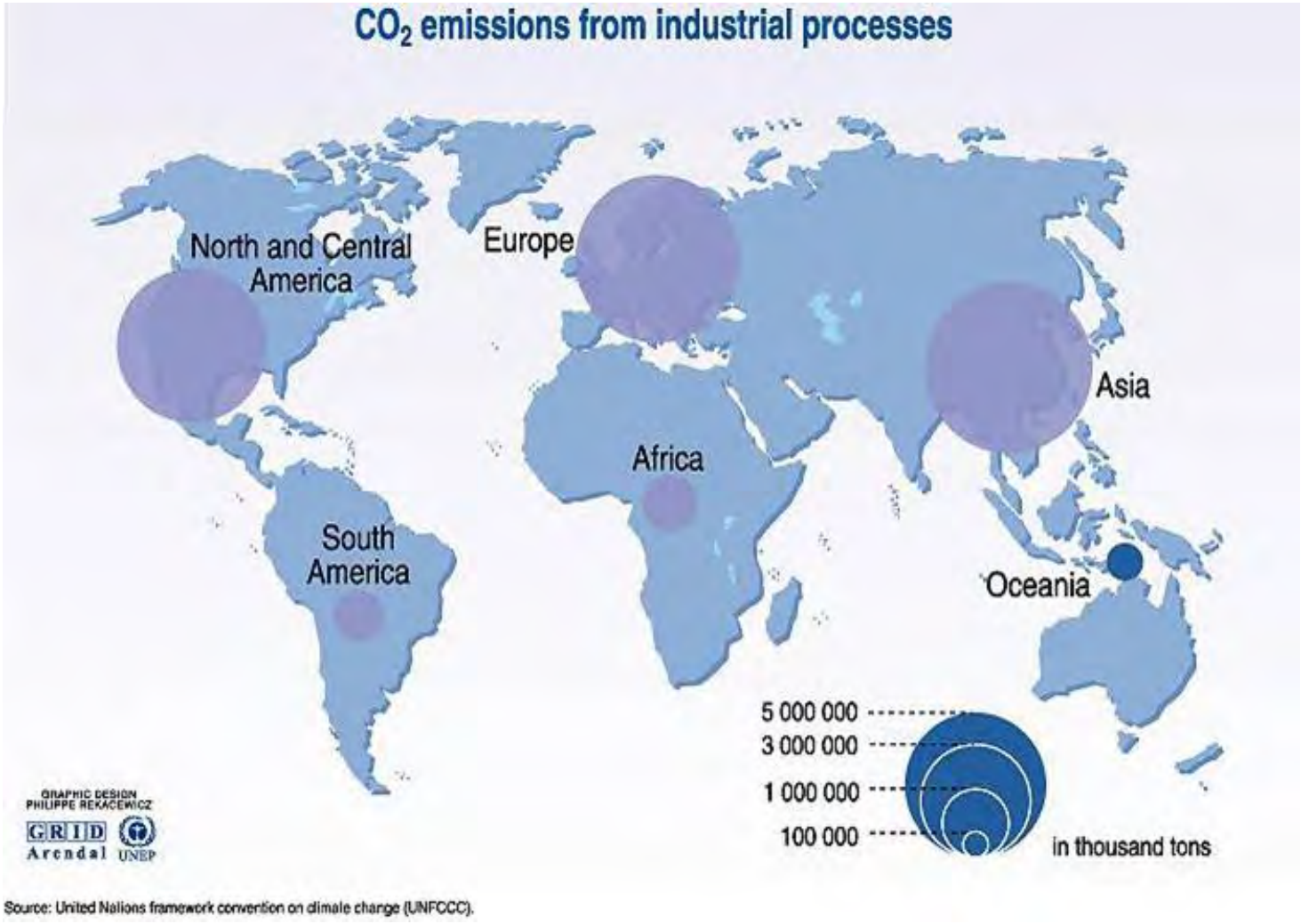
Which consequences does this have?



Sources: TP Whorf Scripps, Mauna Loa Observatory, Hawaii, institution of oceanography (SIO), university of California La Jolla, California, United States, 1999

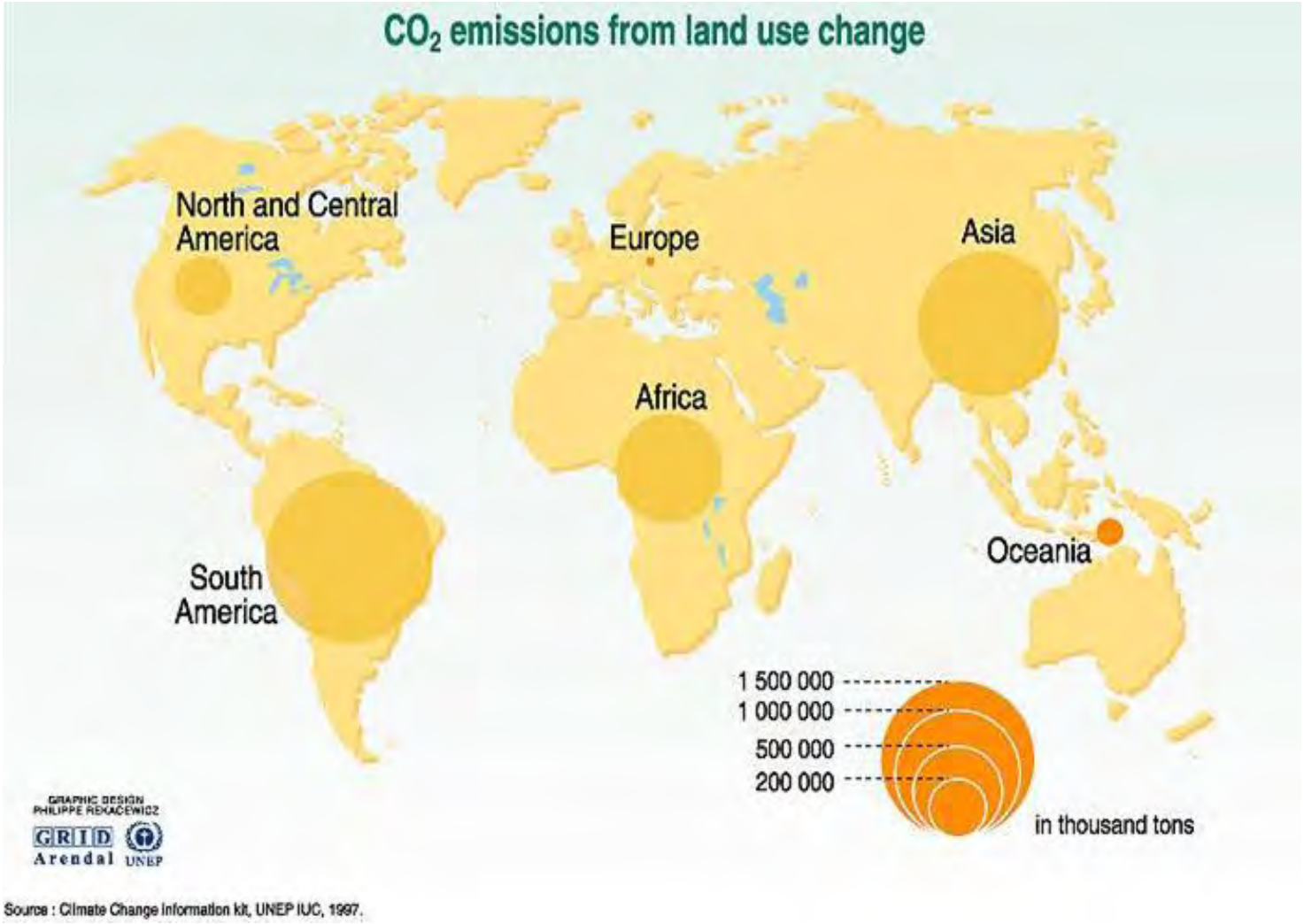
Source: www.grida.no/climate/vital/07.htm

Which consequences does this have?



Source: www.grida.no/climate/vital/09.htm

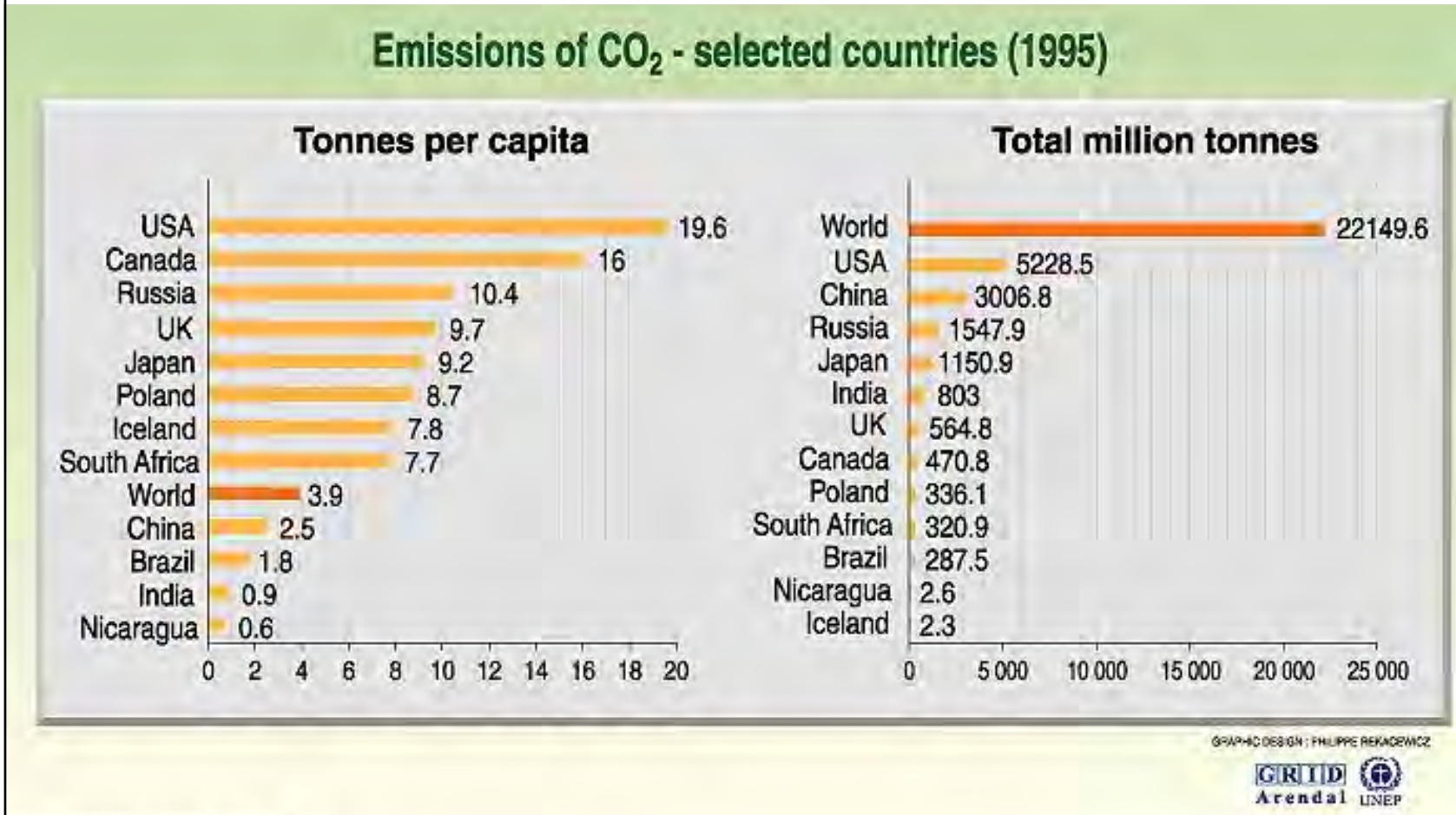
Which consequences does this have?



Source : Climate Change information kit, UNEP IUC, 1997.

Source: www.grida.no/climate/vital/10.htm

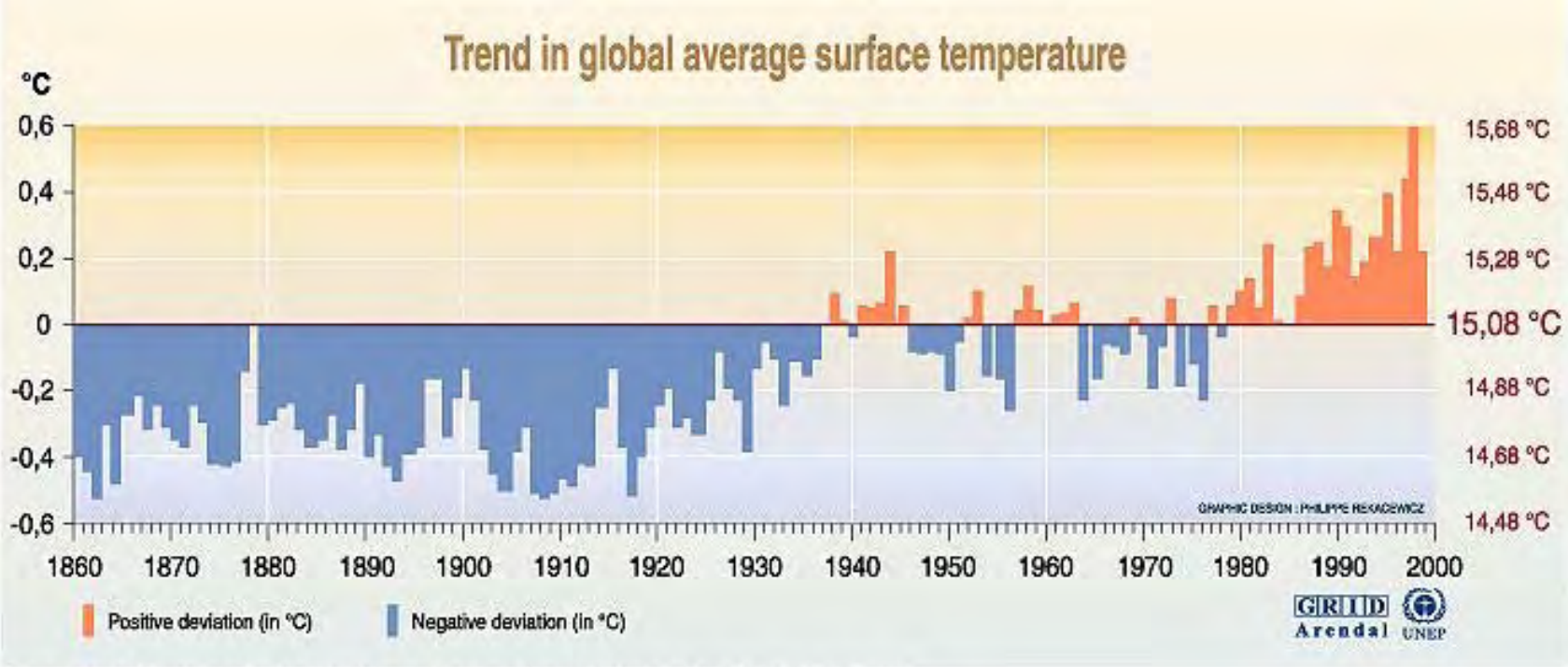
Which consequences does this have?



Source: www.grida.no/climate/vital/11.htm

Which consequences does this have?

Aspects of Climate change

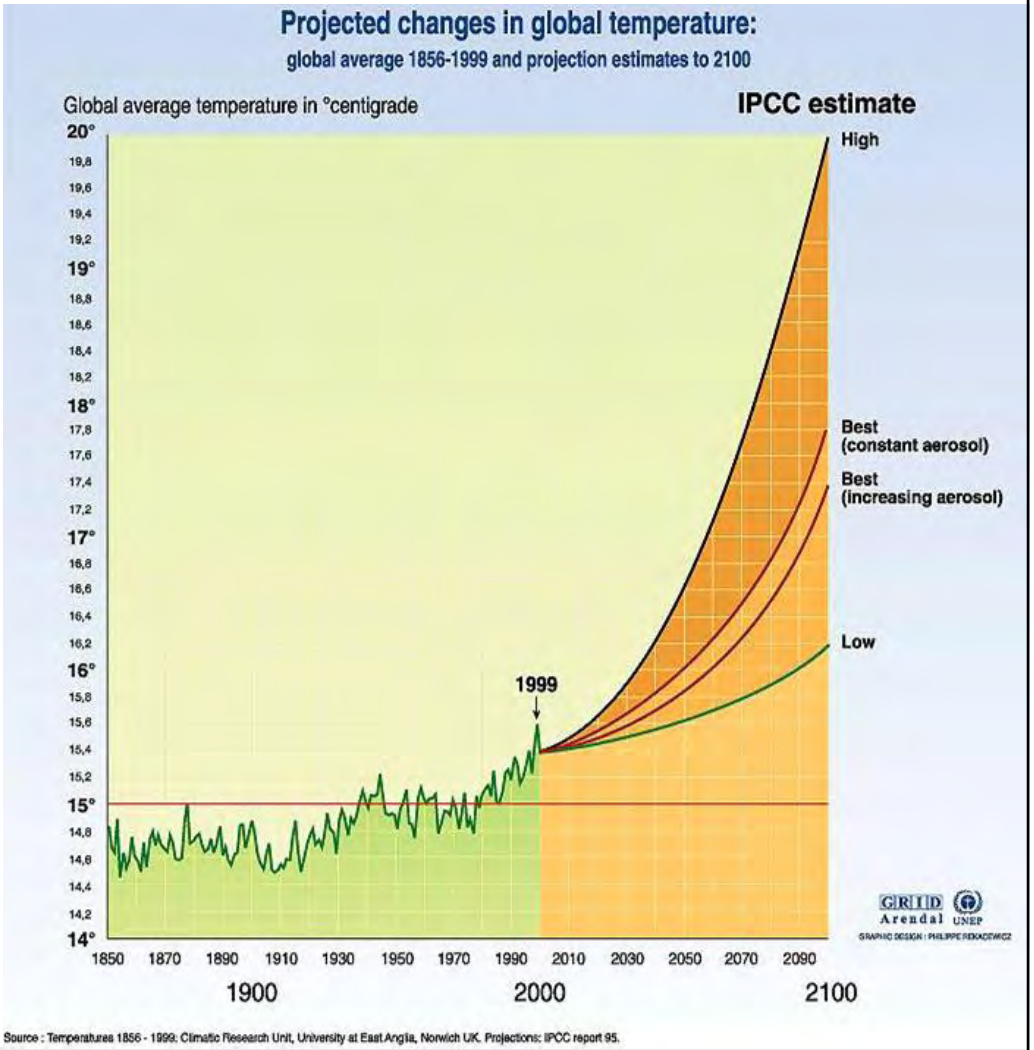


Source: School of environmental sciences, climatic research unit, university of East Anglia, Norwich, United Kingdom, 1999.

Source: www.grida.no/climate/vital/17.htm

Which consequences does this have?

Aspects of Climate change



Source : Temperatures 1856 - 1999: Climatic Research Unit, University at East Anglia, Norwich UK. Projections: IPCC report 95.

Source: www.grida.no/climate/vital/23.htm

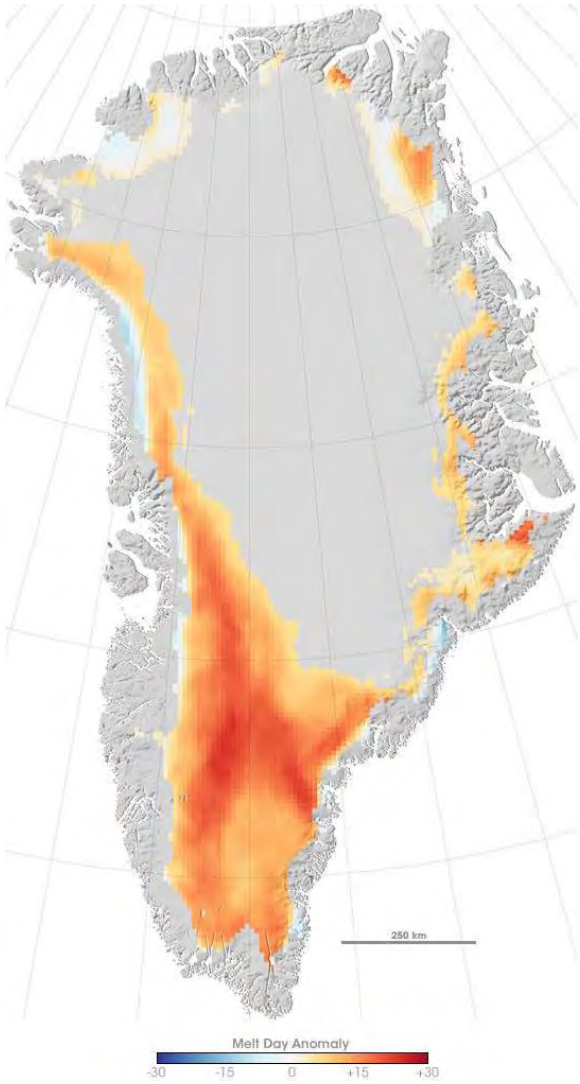
Which consequences does this have?

Aspects of Climate change

"Visible" Melting Anomalies on Greenland in 2007

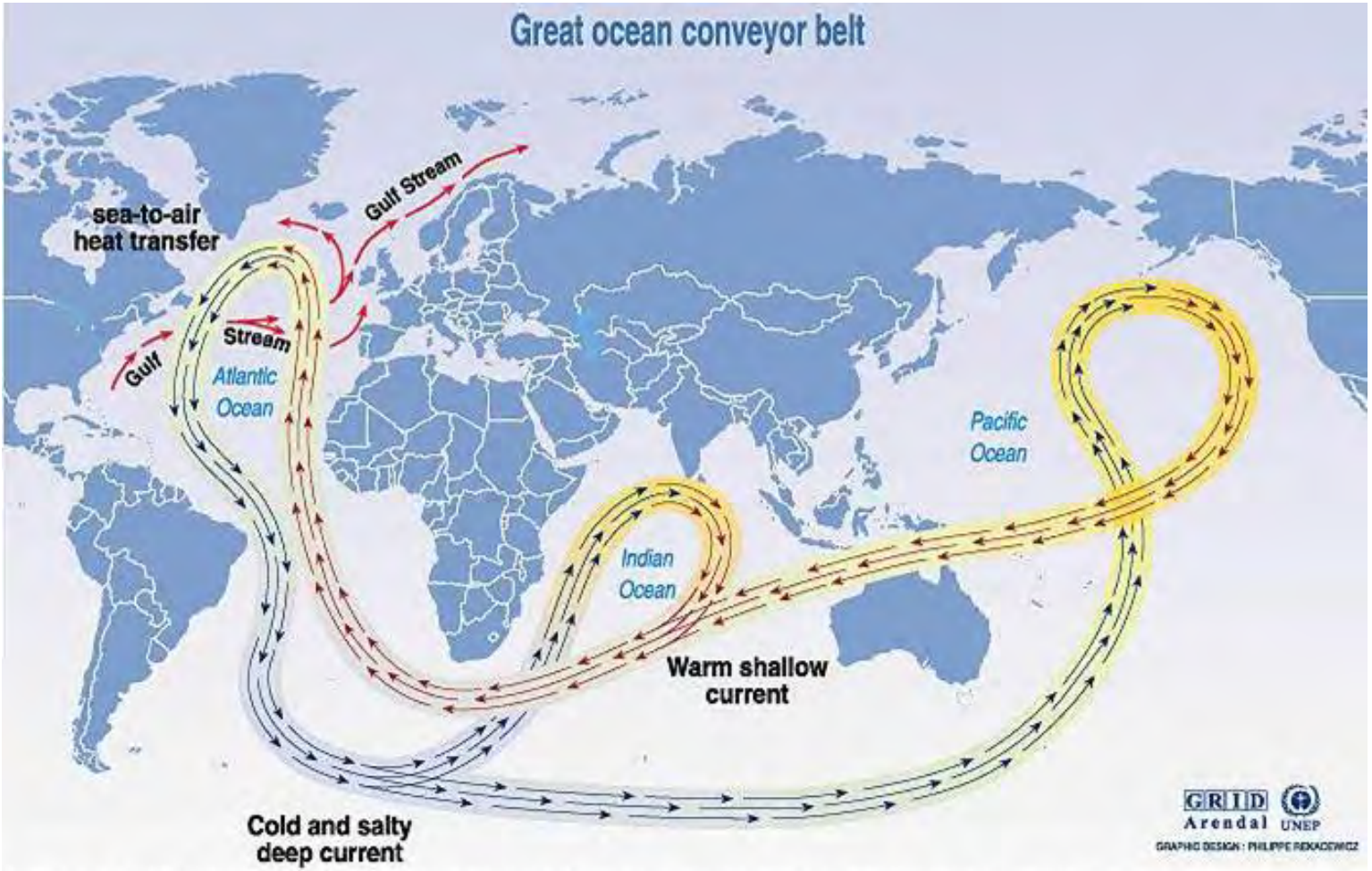
The warmer climate causes the melting of artic ice.
- More melting water,
- more fresh water,
- change of the salt content in the sea water,
- danger of influence on ocean currents.

Benefit for the local people:
- Less ice on the sea
- More possibilities for fishing



Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17846

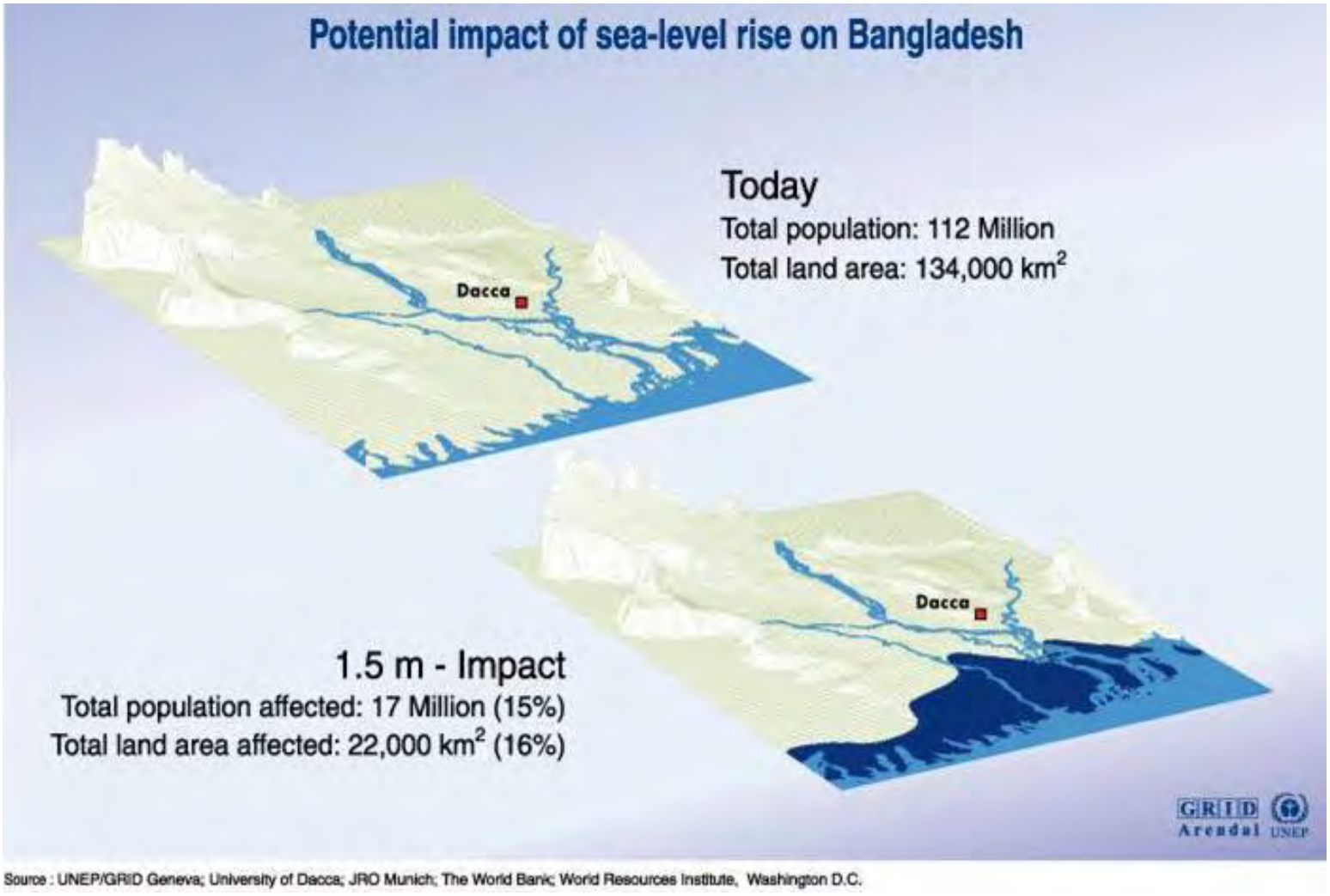
Which consequences does this have?



Source: Broecker, 1991, in Climate change 1995, Impacts, adaptations and mitigation of climate change: scientific-technical analyses, contribution of working group 2 to the second assessment report of the intergovernmental panel on climate change, UNEP and WMO, Cambridge press university, 1996.

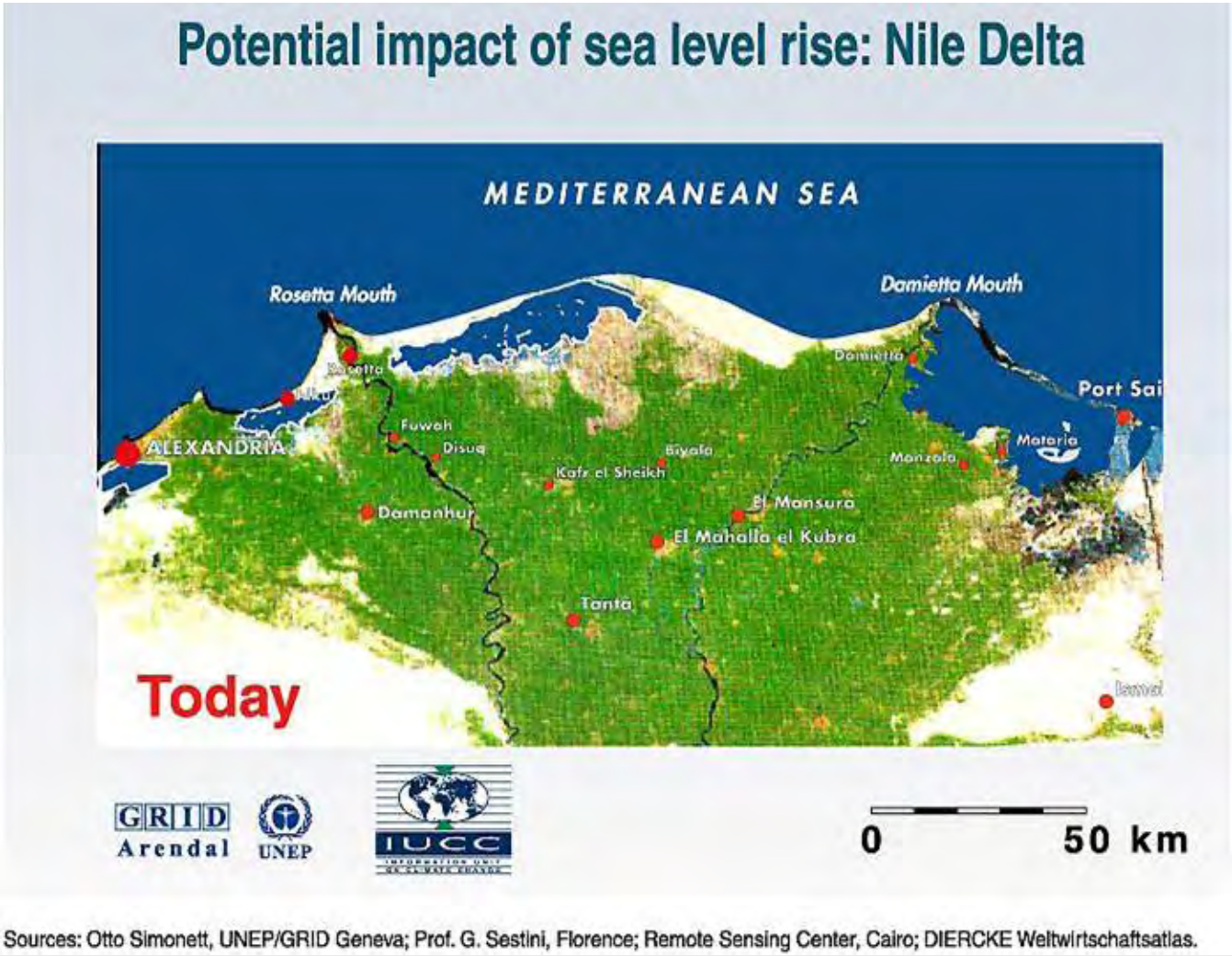
Source: www.grida.no/climate/vital/32.htm

Which consequences does this have?



Source: www.grida.no/climate/vital/33.htm

Which consequences does this have?

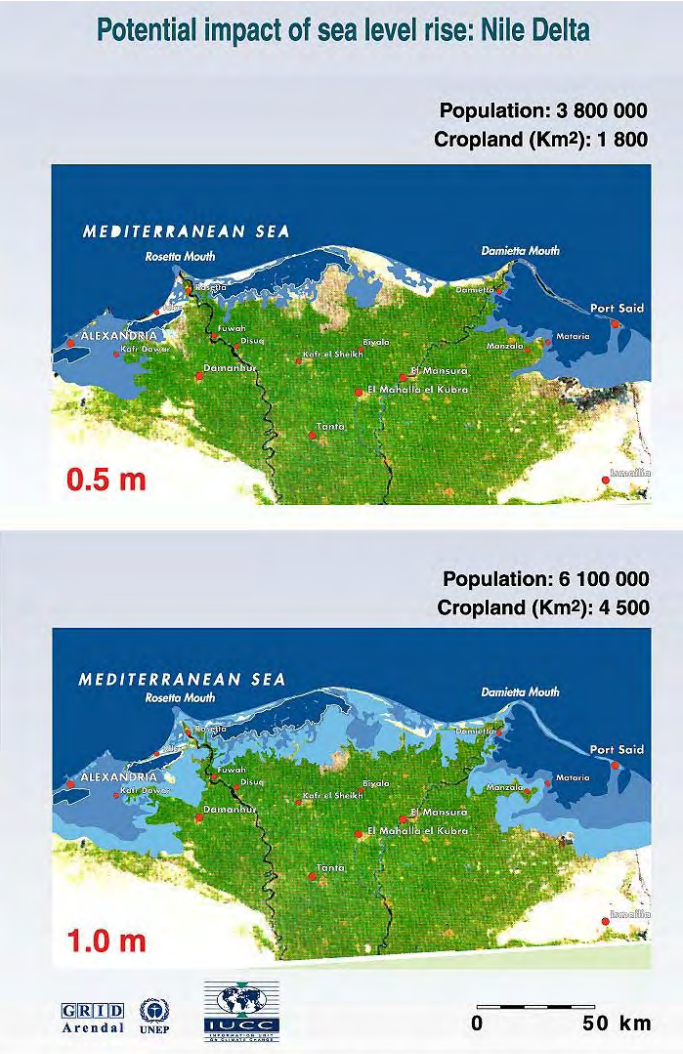


Sources: Otto Simonett, UNEP/GRID Geneva; Prof. G. Sestini, Florence; Remote Sensing Center, Cairo; DIERCKE Weltwirtschaftsatlas.

Source: www.grida.no/climate/vital/34a.htm

Which consequences does this have?

Aspects of Climate change



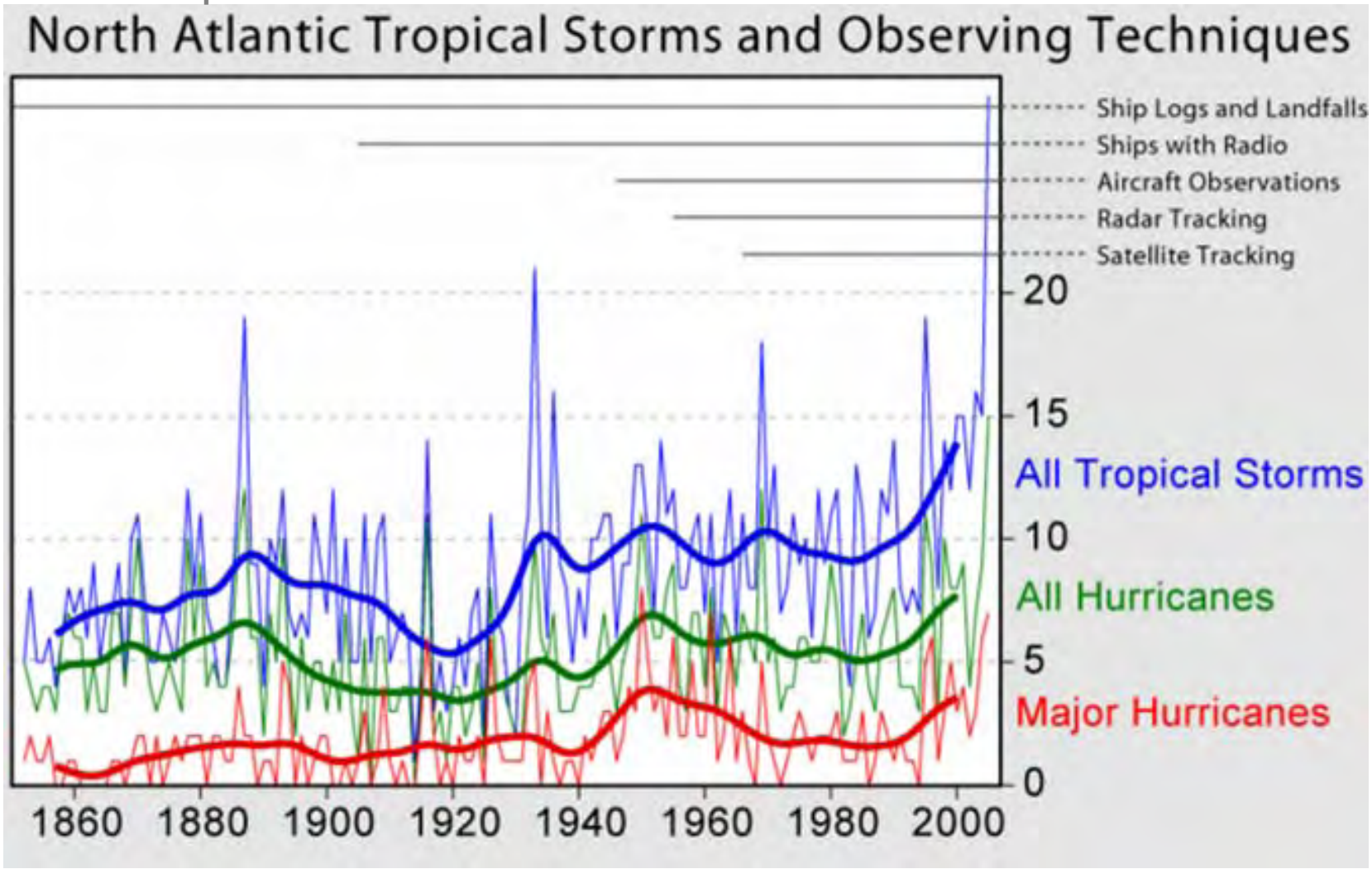
Sources: Otto Simonett, UNEP/GRID Geneva; Prof. G. Sestini, Florence; Remote Sensing Center, Cairo; DIERCKE Weltwirtschaftsatlas.

Source: www.grida.no/climate/vital/34a.htm

Which consequences does this have?

Source: www.globalwarmingart.com/wiki/Image:Hurricane_Katrina_jpg

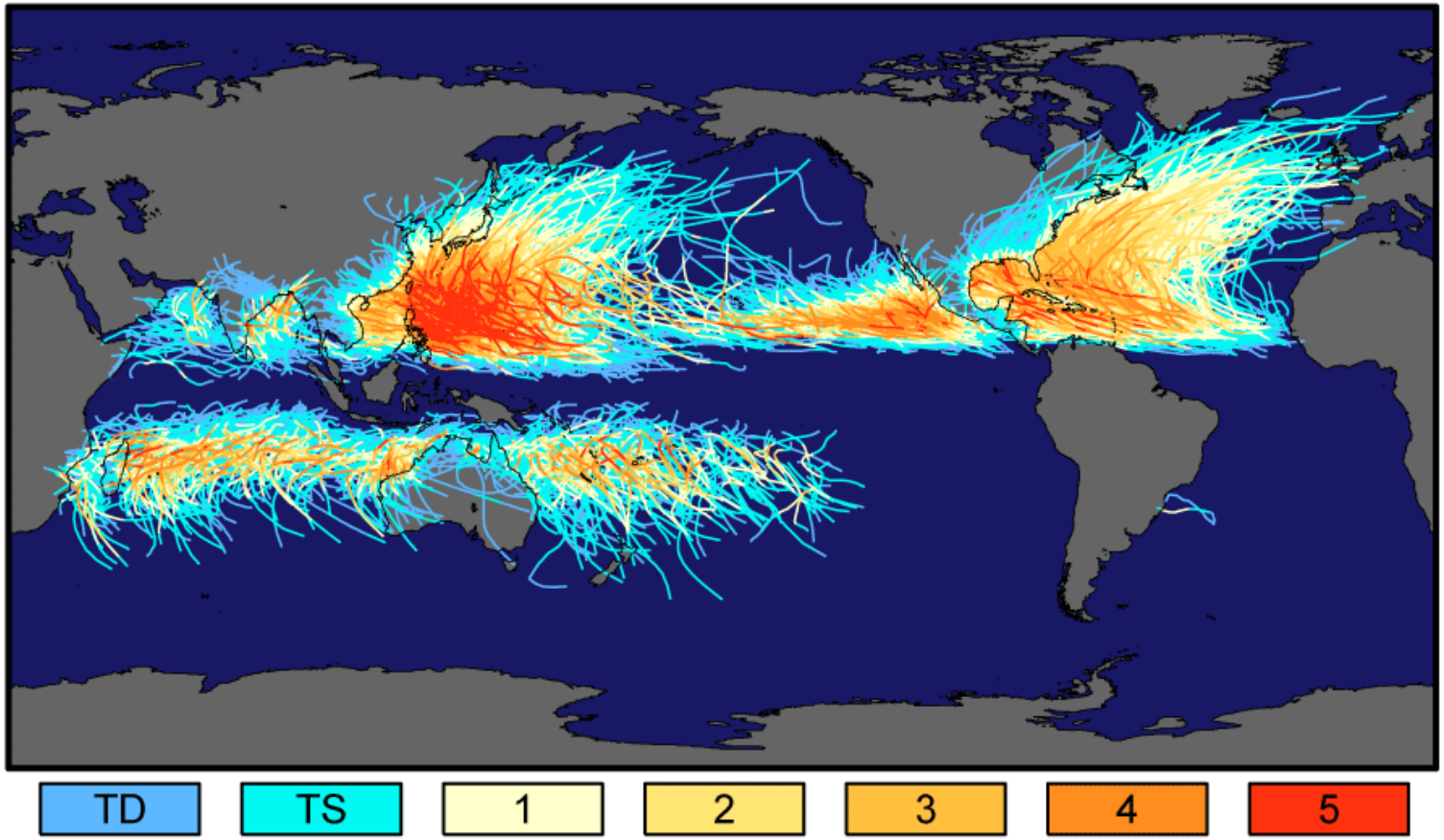
Which consequences does this have?



Source: www.globalwarmingart.com/wiki/Image:North_Atlantic_Hurricane_History_png

Which consequences does this have?

Tracks and Intensity of All Tropical Storms

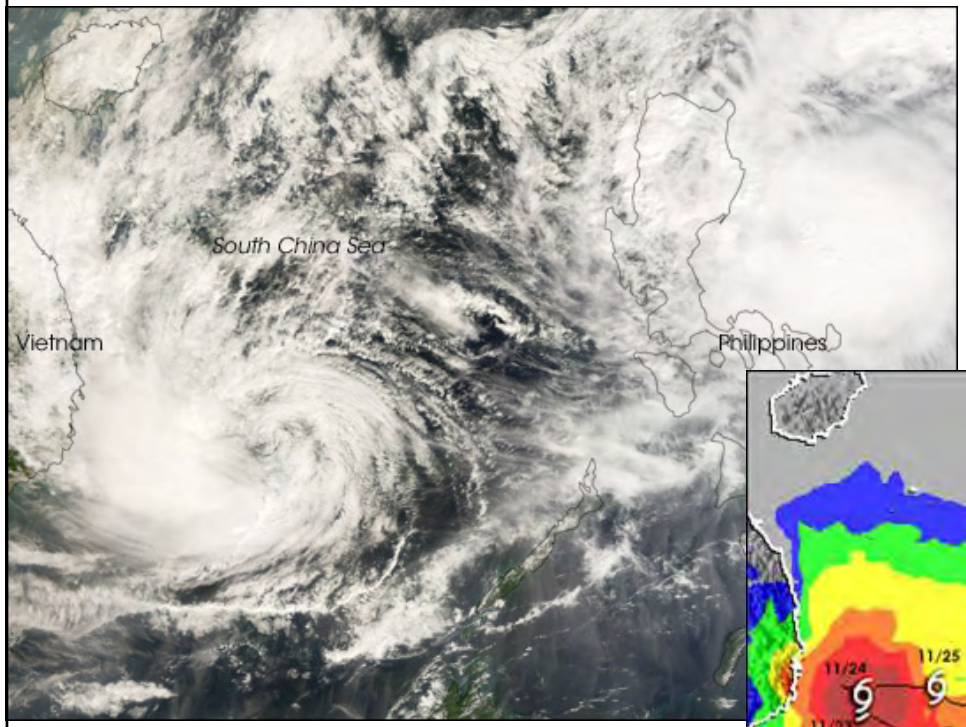


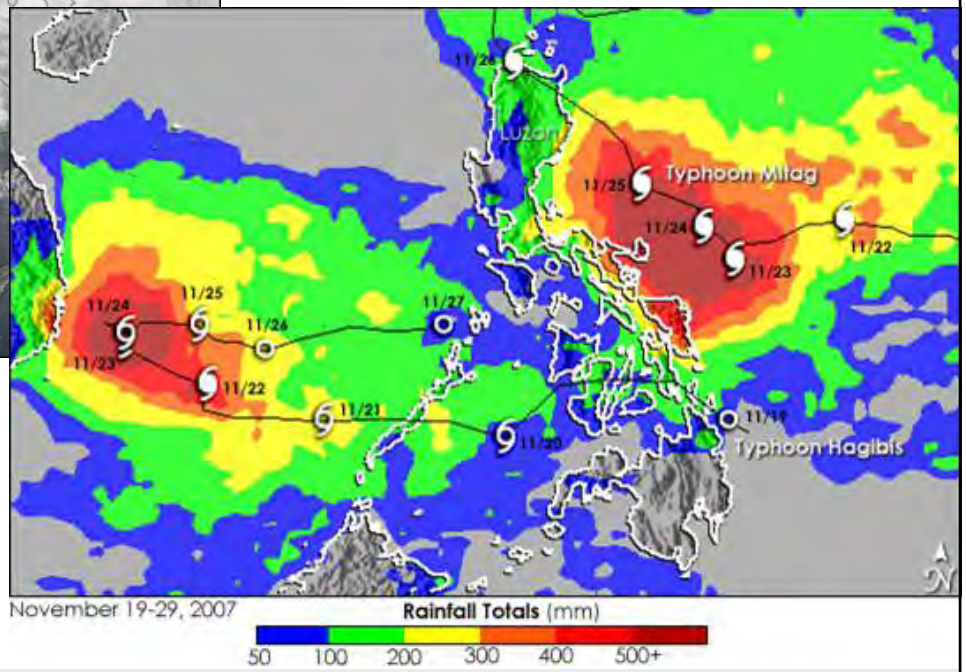
Saffir-Simpson Hurricane Intensity Scale

Source: www.globalwarmingart.com/images/5/55/Tropical_Storm_Map.png

Which consequences does this have?

Aspects of Climate change





Double cyclones strike Philippines

Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17848

Which consequences does this have?

Aspects of Climate change

Partially bleached coral

If the water becomes warmer, the coral will die (white coloured)

Source: www.globalwarmingart.com/wiki/Image:Partially_Bleached_Coral_jpg

CONSIDERATION NO. 4:

How can we build better?

How can we build better?

CONSIDERATIONS …

Conclusion 1

How can we build better?

The Ranking of the functions is:

1. External shell

2. Load carrying structure

(Form follows function!)

Source:

How can we build better?

CONSIDERATIONS …

Conclusion 2

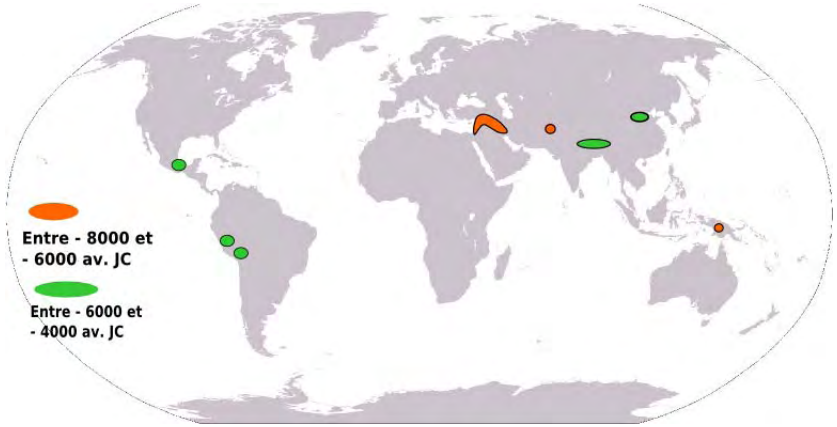
Source:

How can we build better?

11,000 BC: The Neolithic Revolution

= transition from nomadic hunting and gathering to agriculture and settlement.

- that means the intelligent use of on-site available resources



Source: http://en.wikipedia.org/wiki/History_of_agriculture http://de.wikipedia.org/wiki/Agrargeschichte

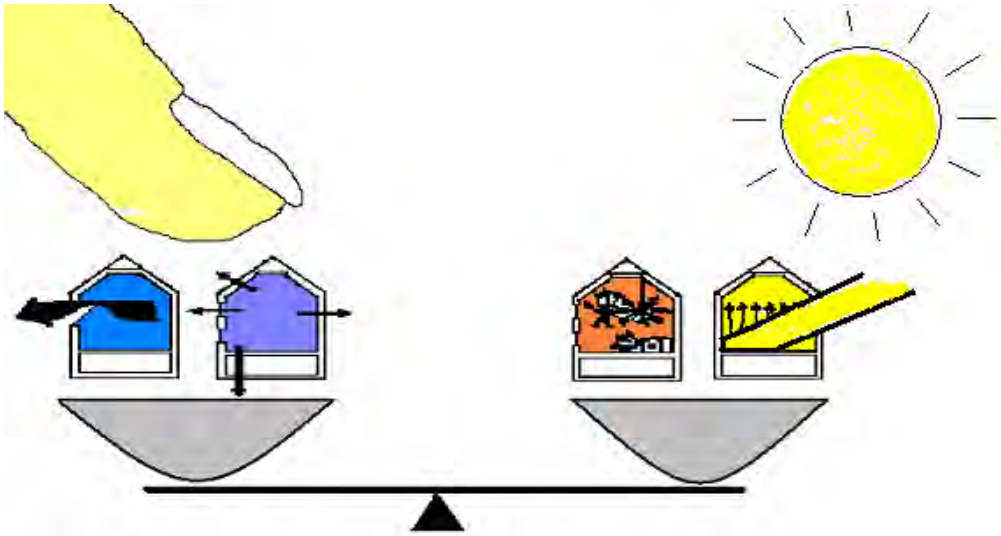
How can we build better?

In the field of energy we carry out hunting and gathering up to today.

Source:

How can we build better?

13,000 years later it is high time to develop buildings which „keep house“ according to the climate with the on-site available resources (sustainability).



Source:

How can we build better?

„We“ are the first generation which is technically able to do this!

Source: BASF, Viessmann, Soltop OPC - collectra.ch

CONSIDERATION NO. 5:

How is the current development?

Source:

How is the current development?

Bizarreness of our days


Landeshauptleute fordern von Regierung:

Jetzt runter mit Energiepreisen

Kärntner Krone

Kronen Zeitung

UNABHÄNGIG

www.krone.at

Klagenfurt, St.-Peter-Str. 5

So wollen wir euch jubeln sehen!

Protestaktionen der Ärzte beginnen jetzt

Mit Messer gegen Mutter

HDTV SAT-Receiver

Now down with energy prices

+


Der Motor

GT-R: 3.8-l-V6-Biturbo; max. Leistung 480 PS, max. Drehmoment 589 Nm; 0 – 100 km/h: 3,7 sec.; Spitze: 308 km/h; lieferbar ab Frühjahr 2009; Neupreis ab EUR 96.600,–.

17 pages „Engine journal“


Motor Journal

liche Geschichte

Achtzylinder mit 4,3 Litern Hubraum und 460 PS bewegt. Die Beschleunigung von 0 bis 100 km/h via Siebengang-DSG soll in vier Sekunden erledigt sein, die CO_2-Belastung nicht mehr als 310 g/km ausmachen. Geplante Markteinführung: Sommer 09.

….. 310 g/km CO_2 …..

… Schizophrenia!!!!

Source:

How is the current development?

Bizarreness of our days

Is this the better alternative?

This vehicle is the incarnation of stupidity,
and operating it with bio-fuel is insanity.

Source: www3.telus.net/public/mcleod78/biohummer.jpg

CONSIDERATION NR. 6:

… but how is the development in the field of buildings ???

Source:

How is the development in the field of buildings?

Also a lot of bizarreness in our days

A “Green-building” hype in the media

- „The world's first green skyscraper“
- „The first sustainable high-rise building in the world“
- „The most environmentally responsible tower ever built“
- „Intelligent …
- „Sustainable …
- „Energy efficient …

Source: Michaele Addington, HARVARD DESIGN MAGAZINE Image courtesy ©atelier SoA architectes

How is the development in the field of buildings?

… but worldwide much fewer real good results !! ?

Source:

How is the development in the field of buildings?

Bizarreness of our days

The older hype in architectural fashion is „Deconstructivism“

*„Beyond gravity“ **

A newer hype in architectural fashion is „Parametricism“

*„Total fluidity on all scales, for all programmes“ * **

That are architectural scenes, landmarks and “icons” if resources didn't count.

But no answer to any problem of our would.

Source: *Coop Himmelblau ** Zaha Hadid

How is the development in the field of buildings?

At present much reminds us of:

A cabaret song of Gerhard Bronner
"*DER WILDE MIT SEINER MASCHIN* "

…. I have no idea where I am going,
but with my bike I am there faster ….

… but do we know where we want to go,
… have to go?

Source: www.preiserrecords.com

CONSIDERATION NO. 7:

Where do we have to go? Are we able to see the right direction?

Source:

Where do we have to go?

… one aspect of energy …

Current world oil production:
= 82 mill. barrels/day

If the current per capita – consumption of the USA were multiplied by 1,2 bil. Chinese, we would need 84 mill. oil barrels/day!

Source:

Where do we have to go?

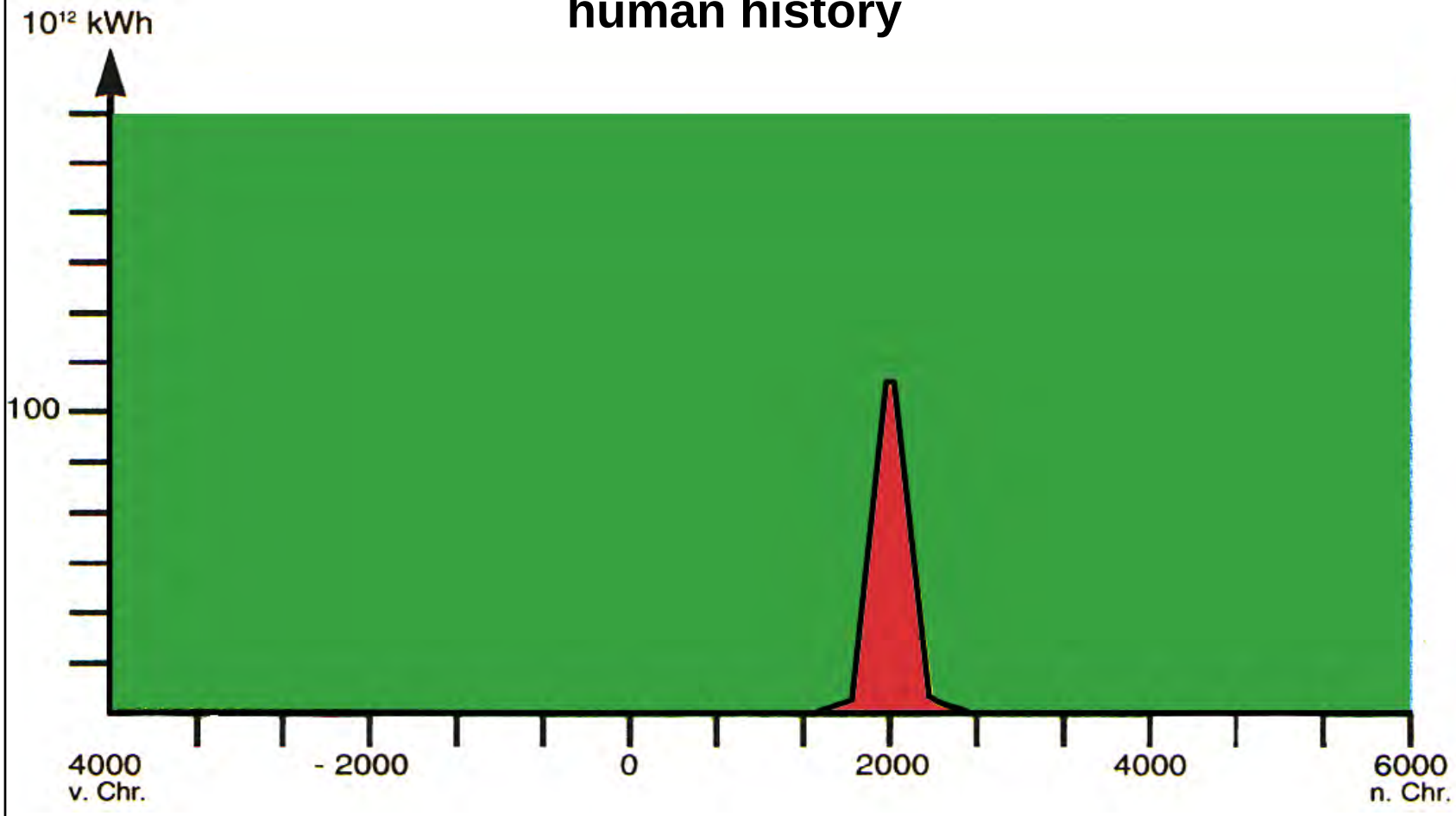
That means if the Chinese had the same consumption as the Americans, they would need all the oil of the world for themselves.

And that means the demand will quickly become bigger than the supply can be.

Source:

Where do we have to go?

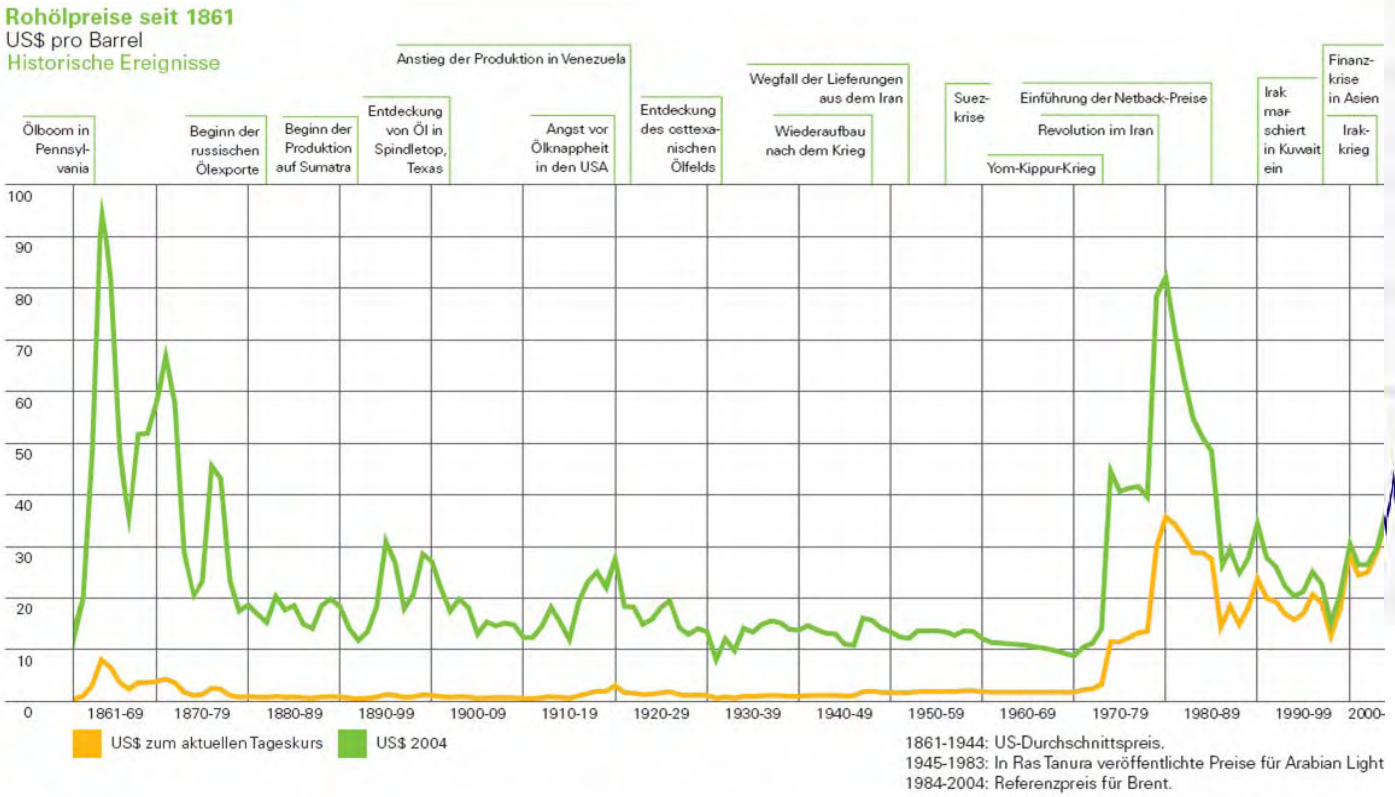
See this illustration as a graph of cheap oil in the time of human history

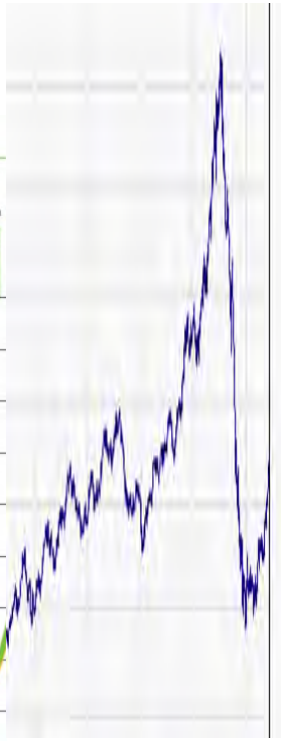


Source: unknown

Where do we have to go?

The price of oil since 1861





The “real” price has been falling till now – especially for Europeans

Source: www.deutschebp.de/liveassets/bp_internet/germany/STAGING/home_assets/assets/deutsche_bp/broschueren/de_oil_section_2005.pdf

Where do we have to go?

A new Imprint in our Socialization

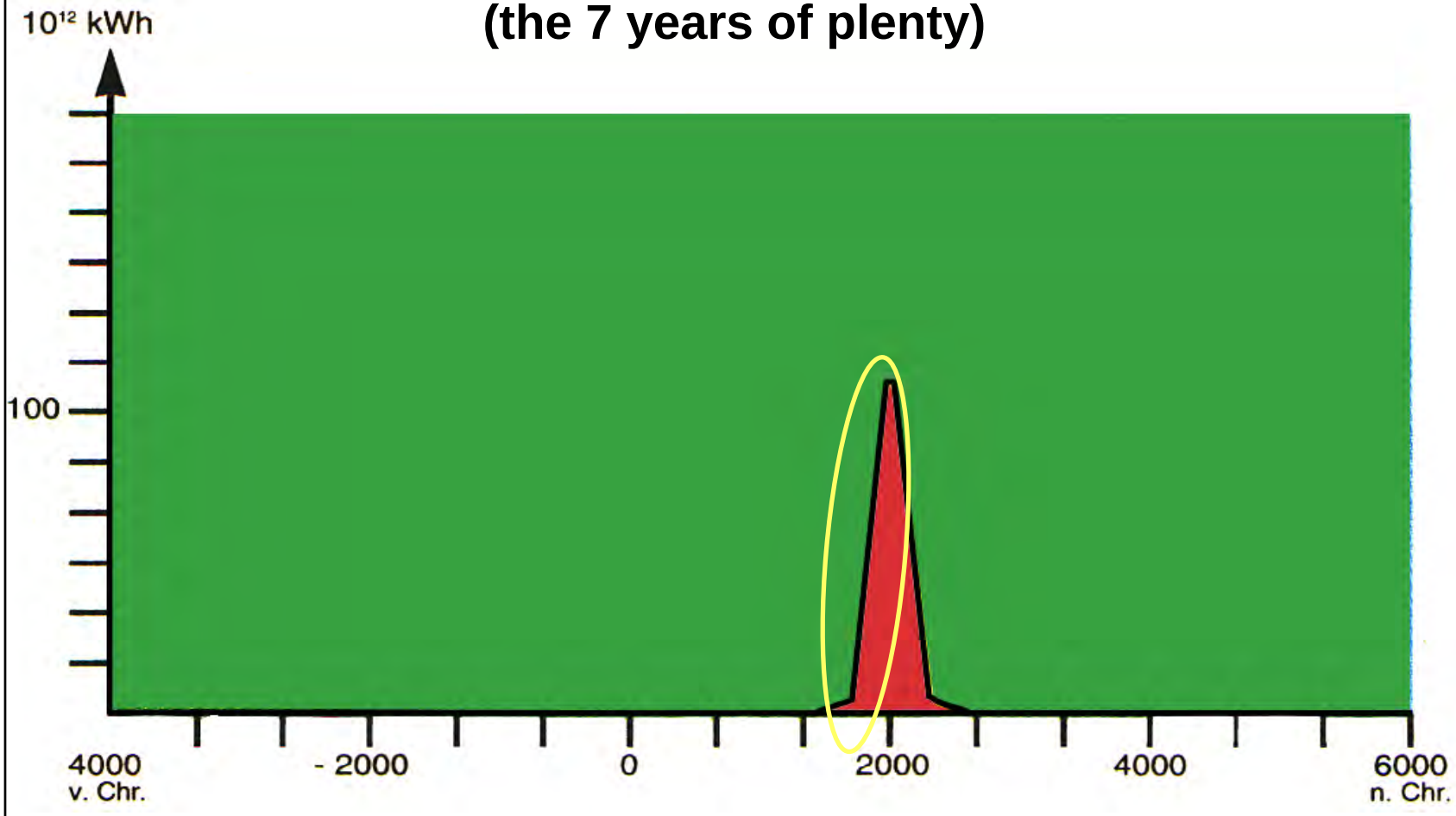
- Primary socialization
  - Family, children of the same age
- Secondary socialization
  - Narrower social environment, norms, values, country
- Tertiary socialization
  - Wider social environment,
  - **Imprint on our mentality for low energy expense**

… the „experience of life" of our generations is very limited in its usefulness for future decisions !!!

Source:

Where do we have to go?

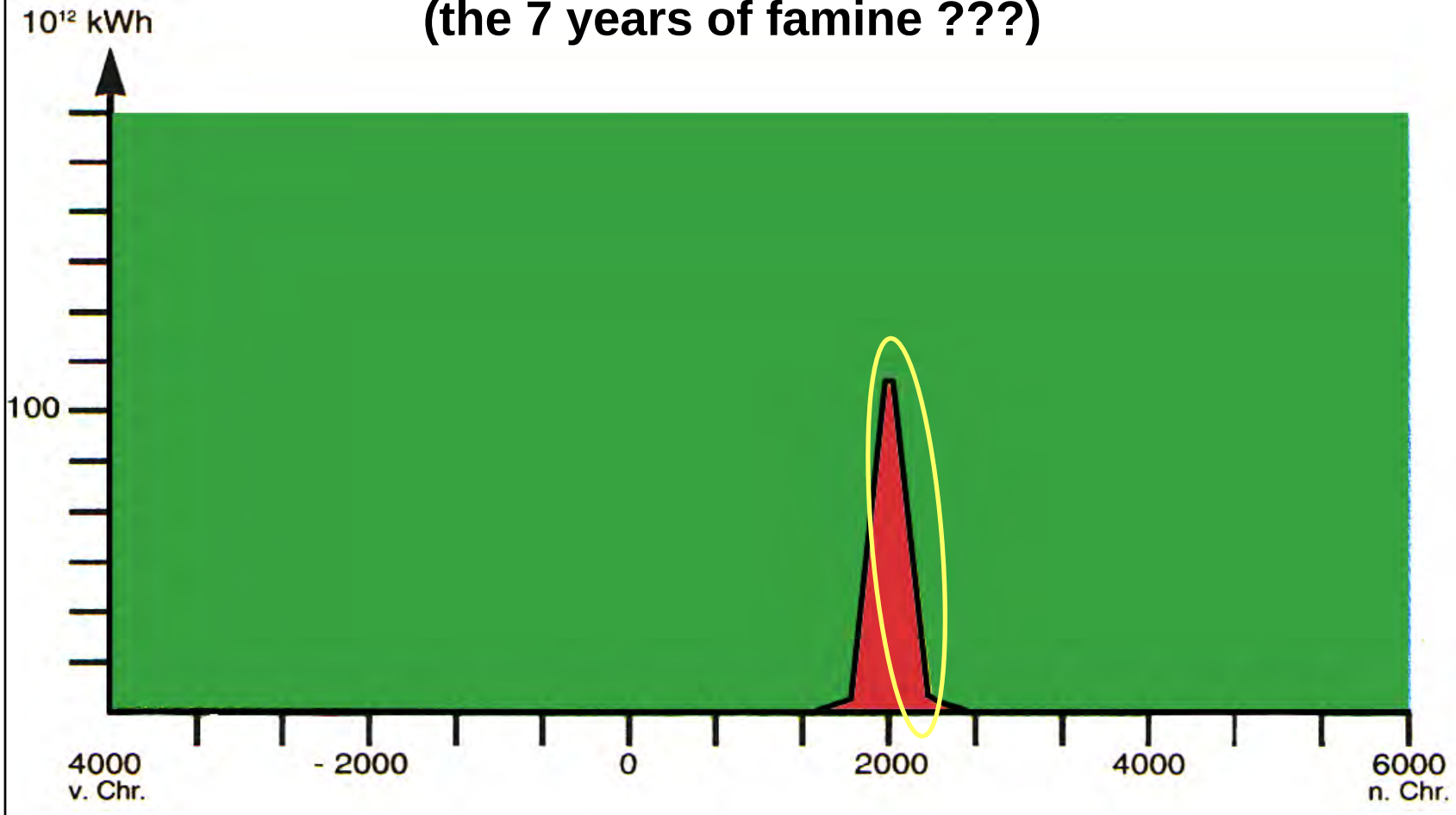
All our experience of life refers to this phase (the 7 years of plenty)



Source: Based on a unknown source

Where do we have to go?

However our decisions should be suitable for this phase (the 7 years of famine ???)



Source: Based on a unknown source

Where do we have to go?

An important saying !!!

A bad strategist always fights the war of the past.

A good strategist always fights the war of the future.

It also works for buildings and architecture!

Source: unknown

Where do we have to go?

A modification of mine !!!

A bad architect designs buildings with his experience of the past.

A good architect designs buildings with the focus to future development.

Source: Ernst Heiduk

CONSIDERATION NO. 8:

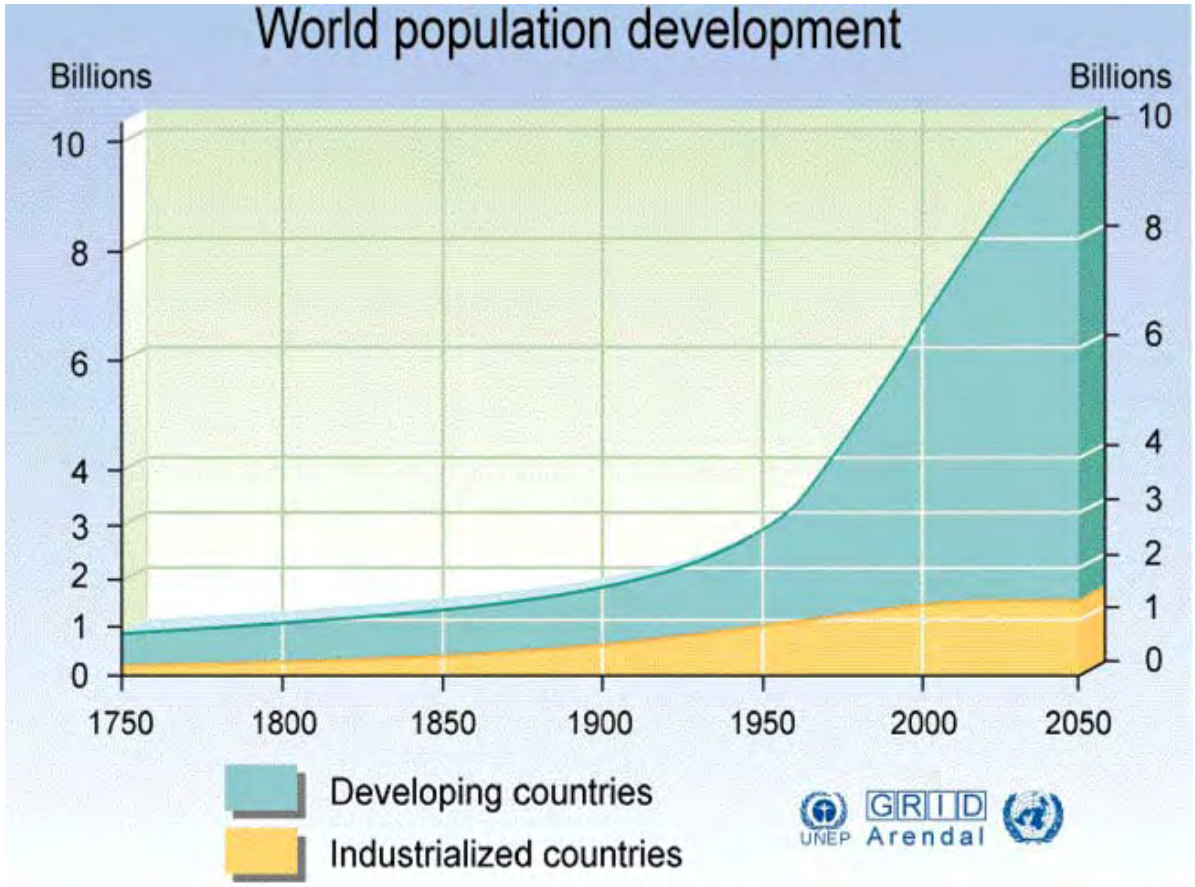
Which developments have to be taken into account?

Source:

Which developments have to be taken into account?

The driving force of future world development:

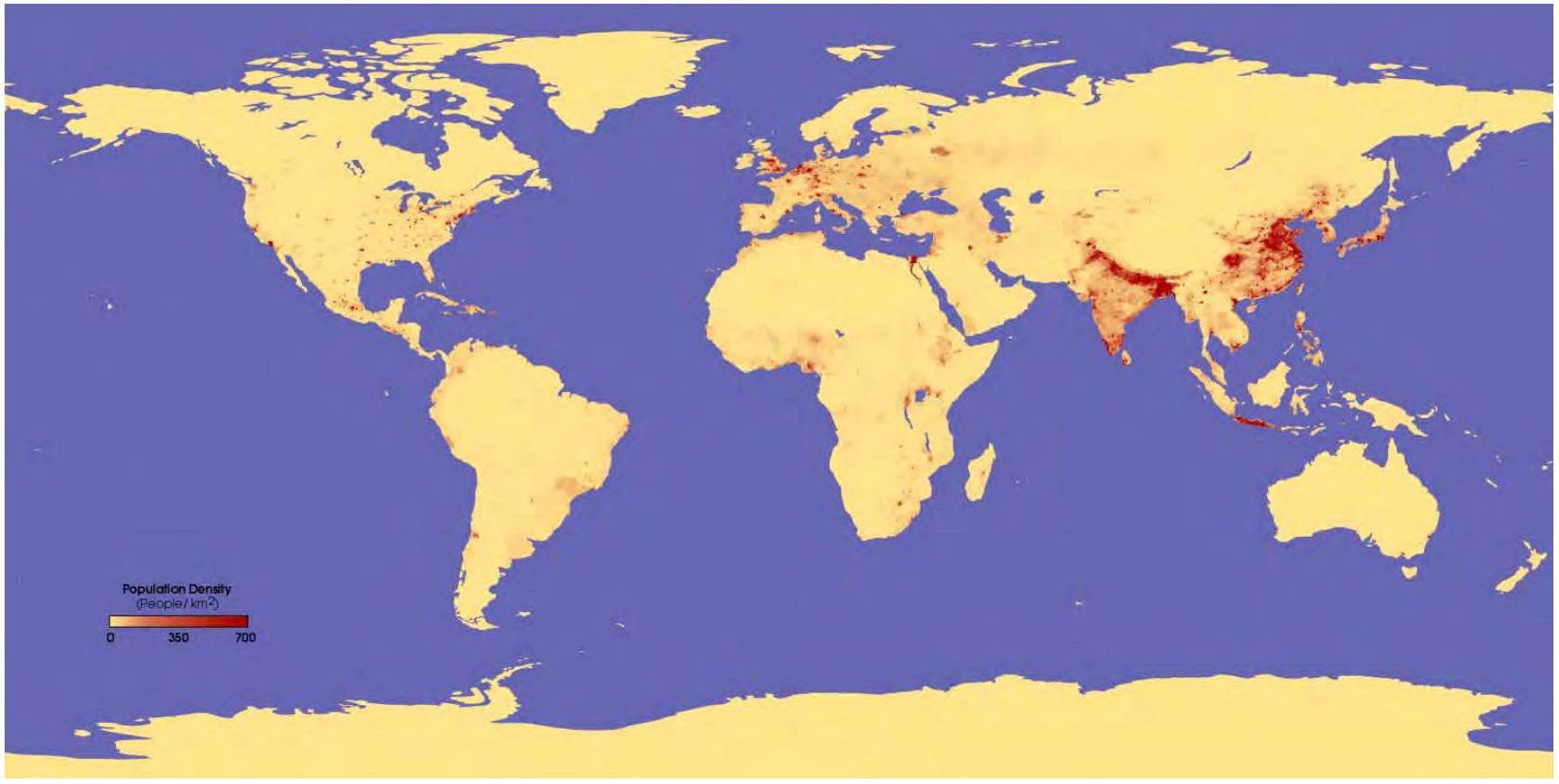
General population development



Source: http://maps.grida.no/library/files/archivetv13_l.gif

Which developments have to be taken into account?

Multiplier:
Local population development



Source: http://upload.wikimedia.org/wikipedia/commons/f/f8/Pop_density.jpg

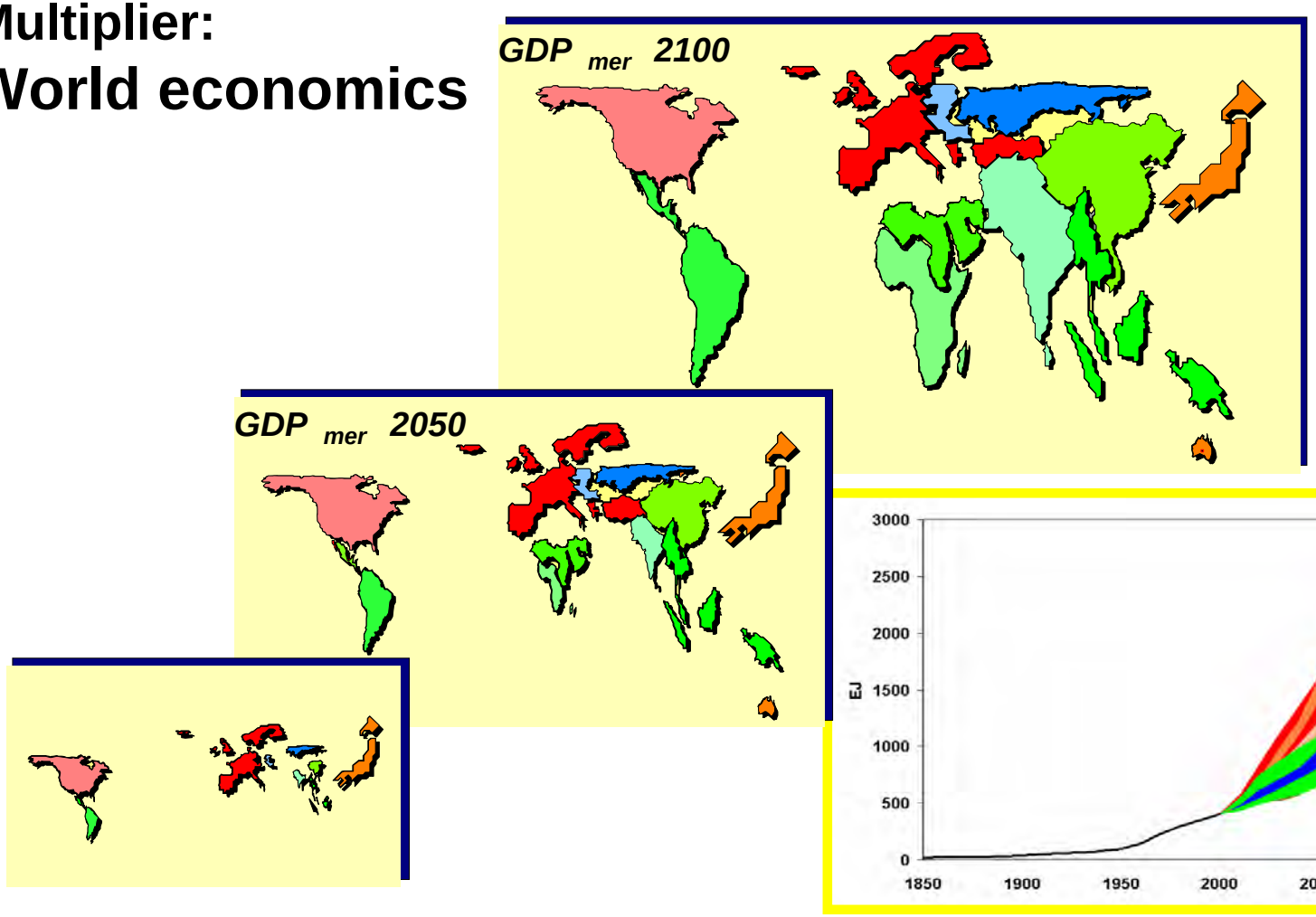
Which developments have to be taken into account?

Multiplier:
World economics

Source: http://en.wikipedia.org/wiki/Image:Earthlights_dmsp.jpg

Which developments have to be taken into account?

Multiplier:
World economics



Source: IIASA - Internationales Institut für angewandte Systemanalyse, Laxenburg

Which developments have to be taken into account?

Multiplier:
Urbanization

1900 **10%** **lived in cities**

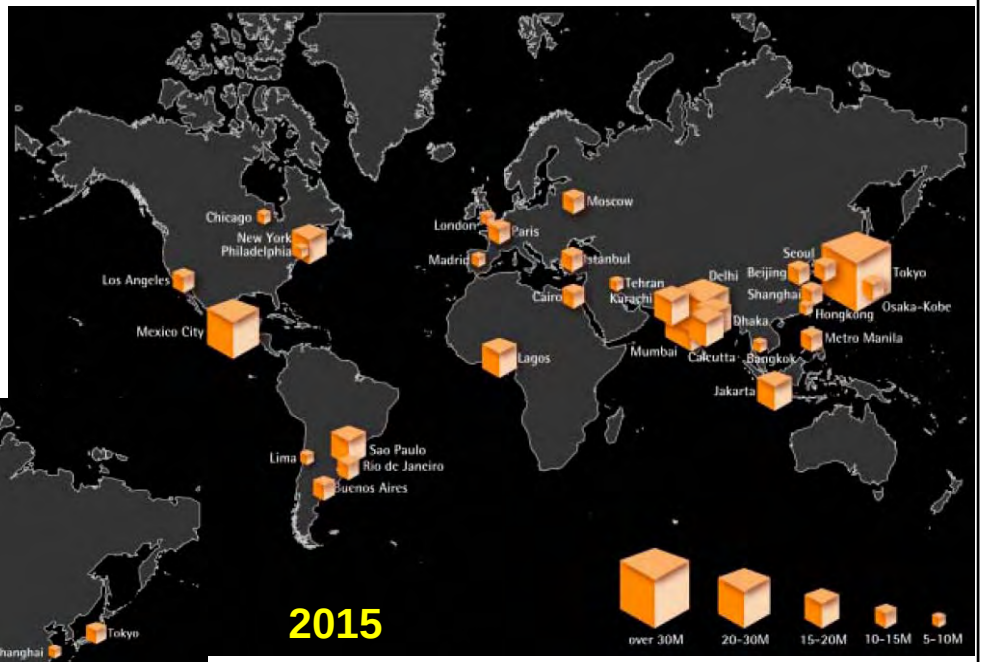
2007 50% **live in cities**

2050 75 % **will be living in cities**

Source: The Endless City, London School of Economics

Which developments have to be taken into account?

Multiplier:
Urbanization



Source: Lecture Norman Foster

Which developments have to be taken into account?

Multiplier:
Urbanization

MEXICO CITY

19 mill. People were living in there in 2000
45,5 x more than in 1900

60% of the construction is done by the informal sector

SHANGHAI

Buildings higher than 8 storeys:

1980	**121**
2000	**3.529**
2005	**10.045**

Source: The Endless City, London School of Economics

Which developments have to be taken into account?

Multiplier:
Transport

Sales start July 2009 - 1,600 Euro

Source: www.abc.net.au/reslib/200706/r155206_559608.jpg www.telegraph.co.uk/motoring/graphics/2008/01/12/mftat3.jpg

Which developments have to be taken into account?

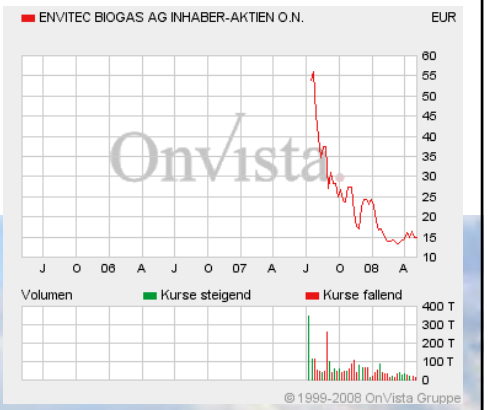
Multiplier:
Transport

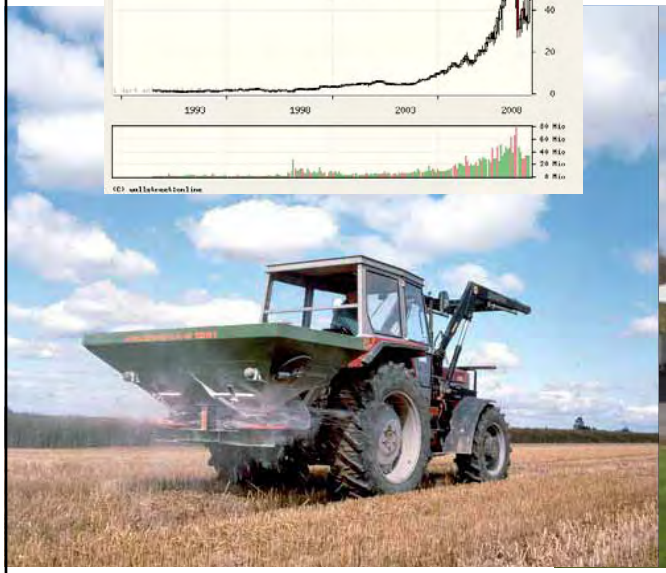
Source: unknown

Which developments have to be taken into account?

Multiplier:
Agriculture / energy

Share prices for fertiliser and biogas plants



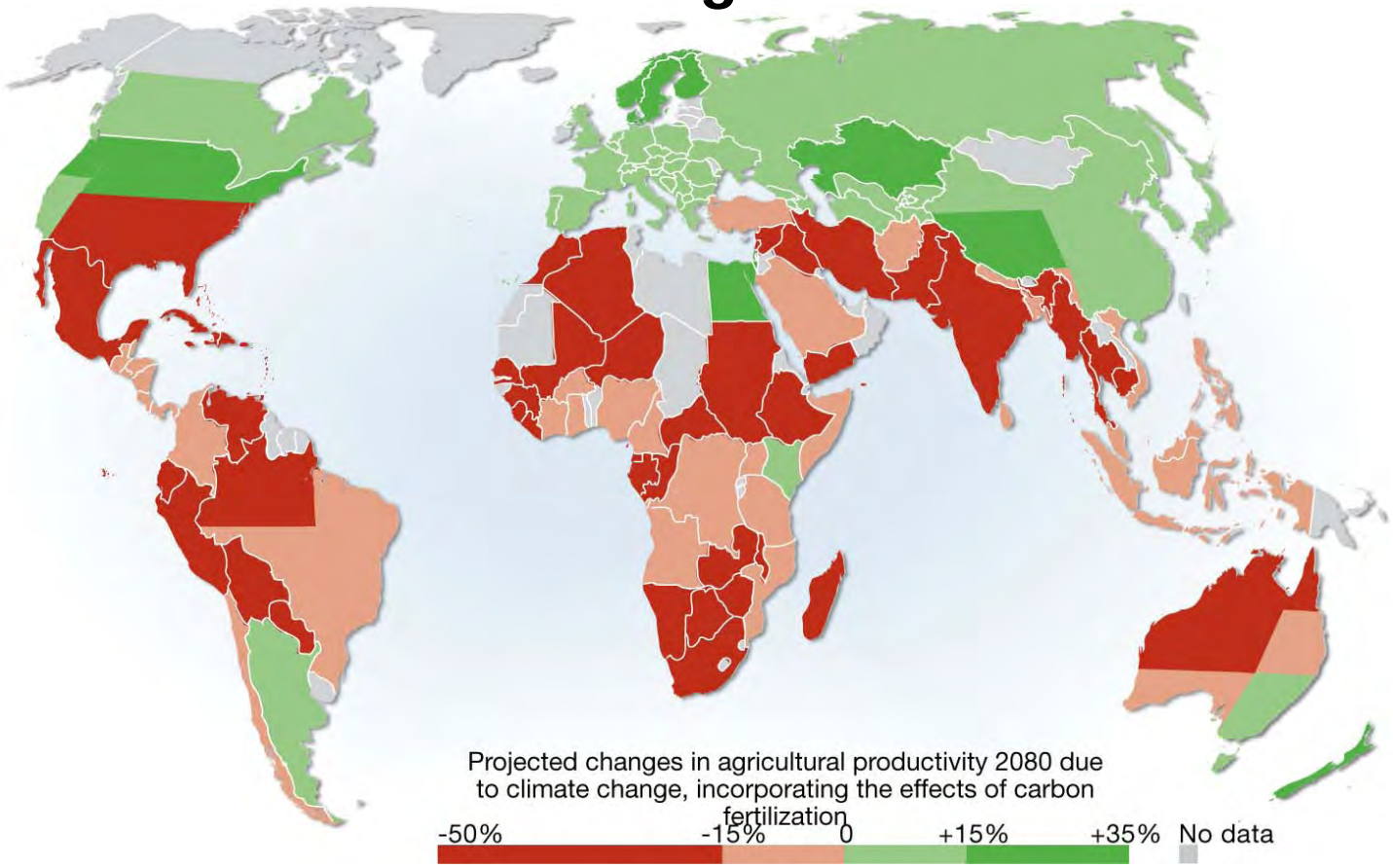


The economic aspects have changed completely within the shortest time.

Source: www.biogas-grimm.de/html/biogas.html

Which developments have to be taken into account?

Problem:
Agriculture / climate change



Source: UNEP

Which developments have to be taken into account?

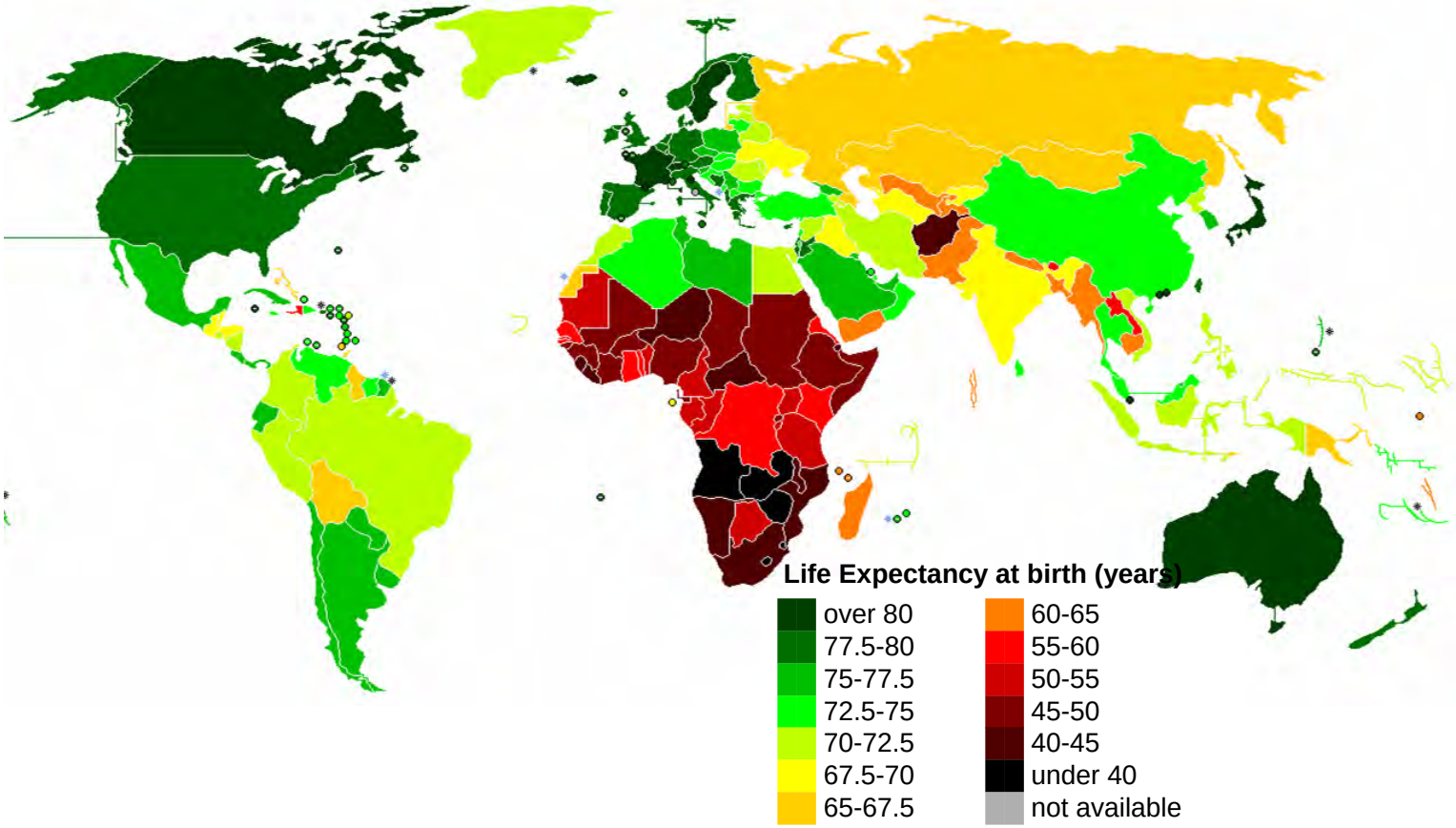
Numerous problems

but also some benefits

Source:

Which developments have to be taken into account?

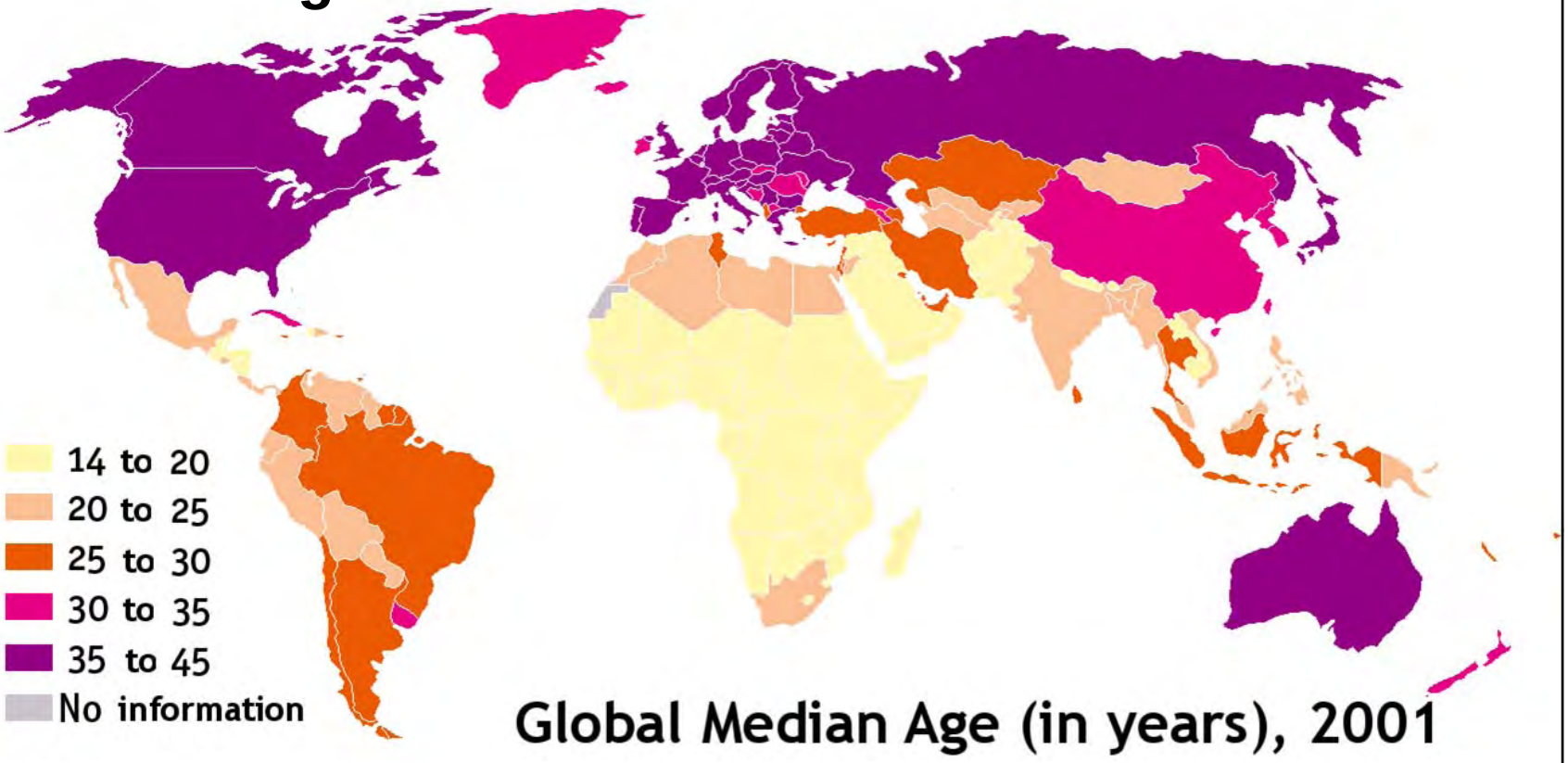
Development:
Life expectancy



Source: http://en.wikipedia.org/wiki/Image:Life_Expectancy_2007_Estimates_CIA_World_Factbook.PNG

Which developments have to be taken into account?

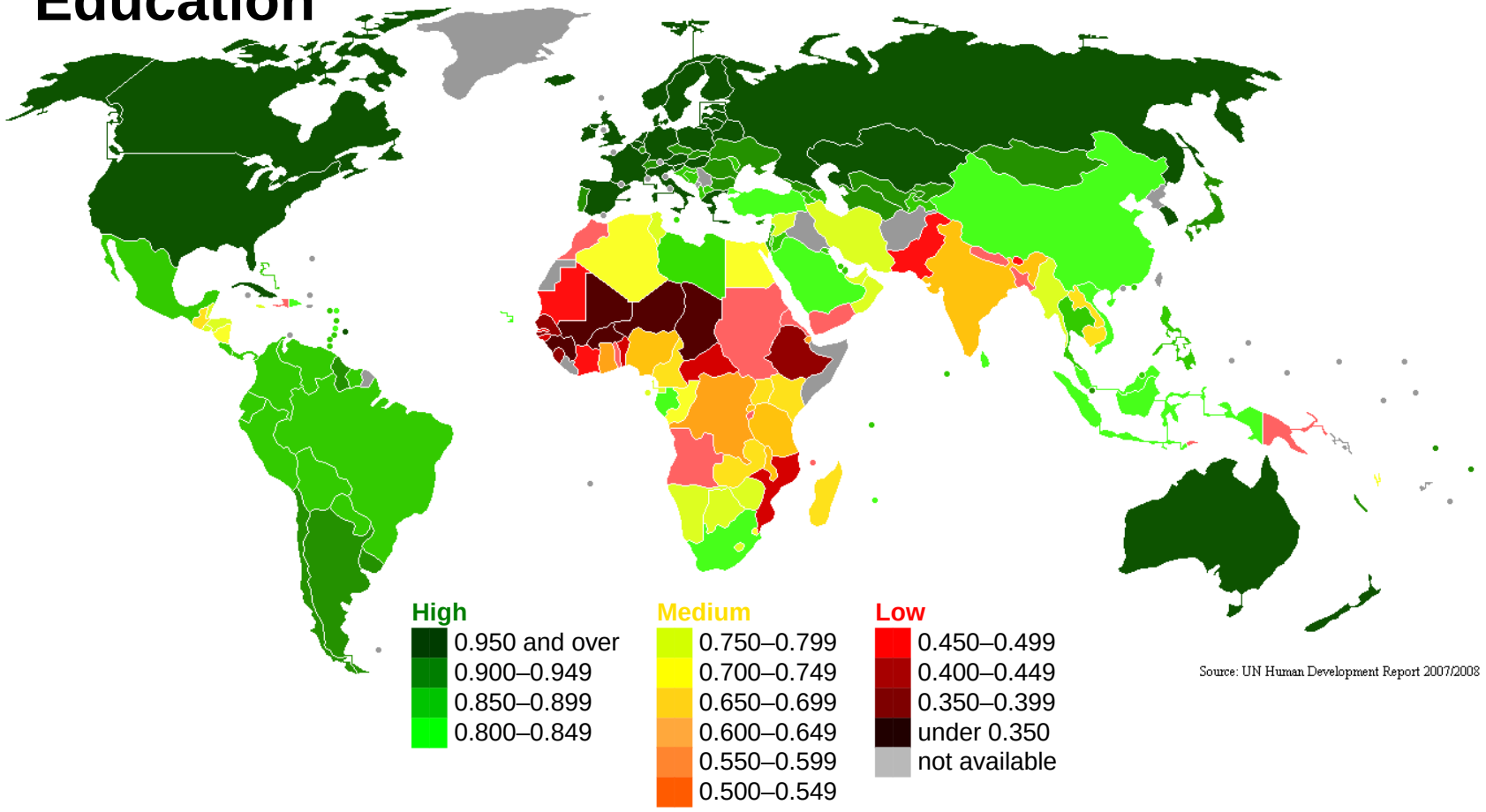
Development:
Median age



Source: http://en.wikipedia.org/wiki/Image:Median_age.png

Which developments have to be taken into account?

Development:
Education



Source: http://en.wikipedia.org/wiki/Image:Education_index_UN_HDR_2007_2008.PNG, Human Development Report

Which developments have to be taken into account?

We all wish ourselves a

– free

– just

– peaceful and

– healthy world

in which we can live well.

Source:

CONSIDERATION NO. 9:

**What can,
what must be the focus,
the objective?**

Source:

What can, what must be the focus, the objective?

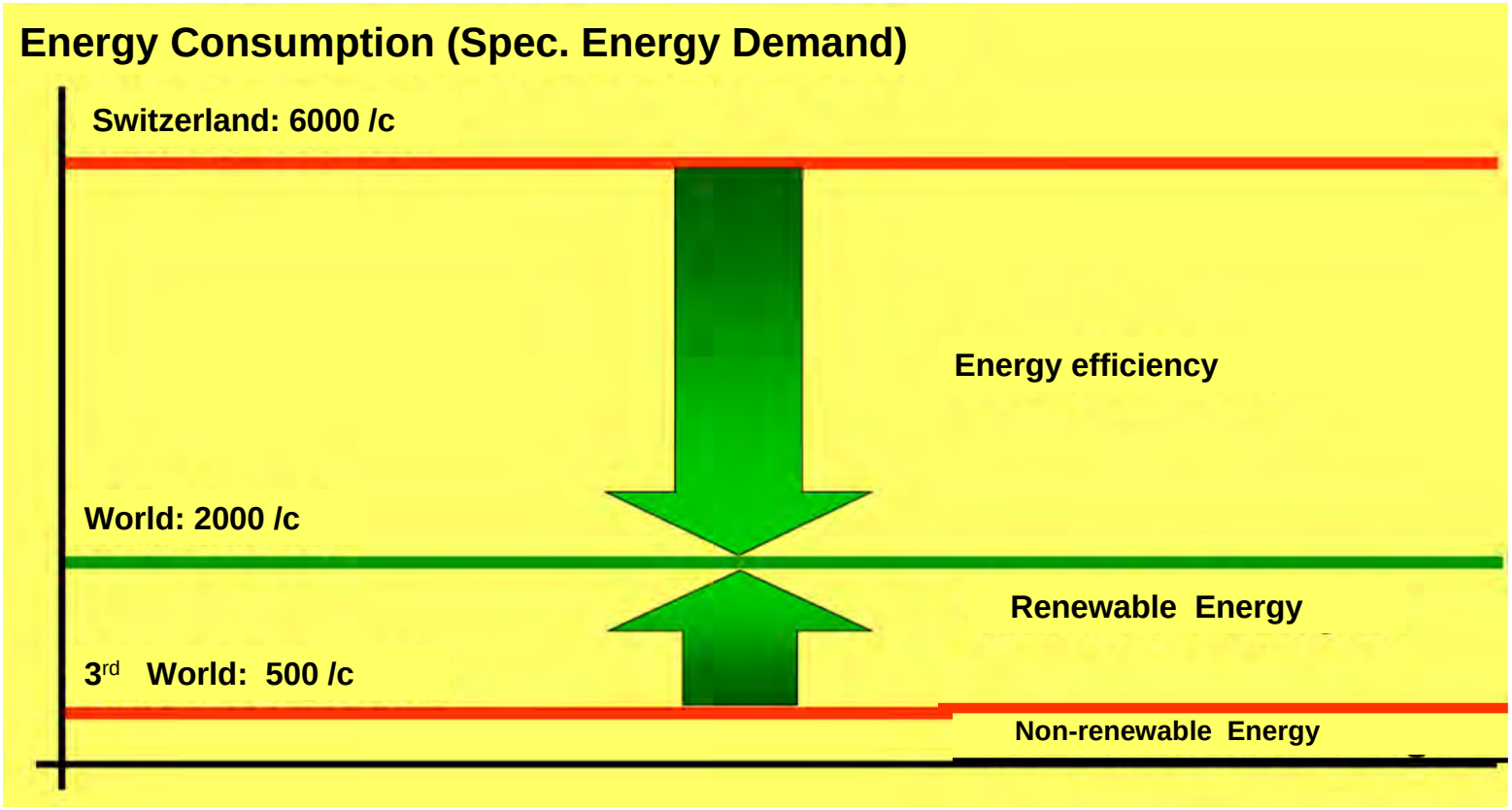
Goals should be:

- A future global perspective > “One world”
- Fairness and justice
- Sustainability

Source:

What can, what must be the focus, the objective?

The ETH Zurich strategy – The 2000-Watt-Society



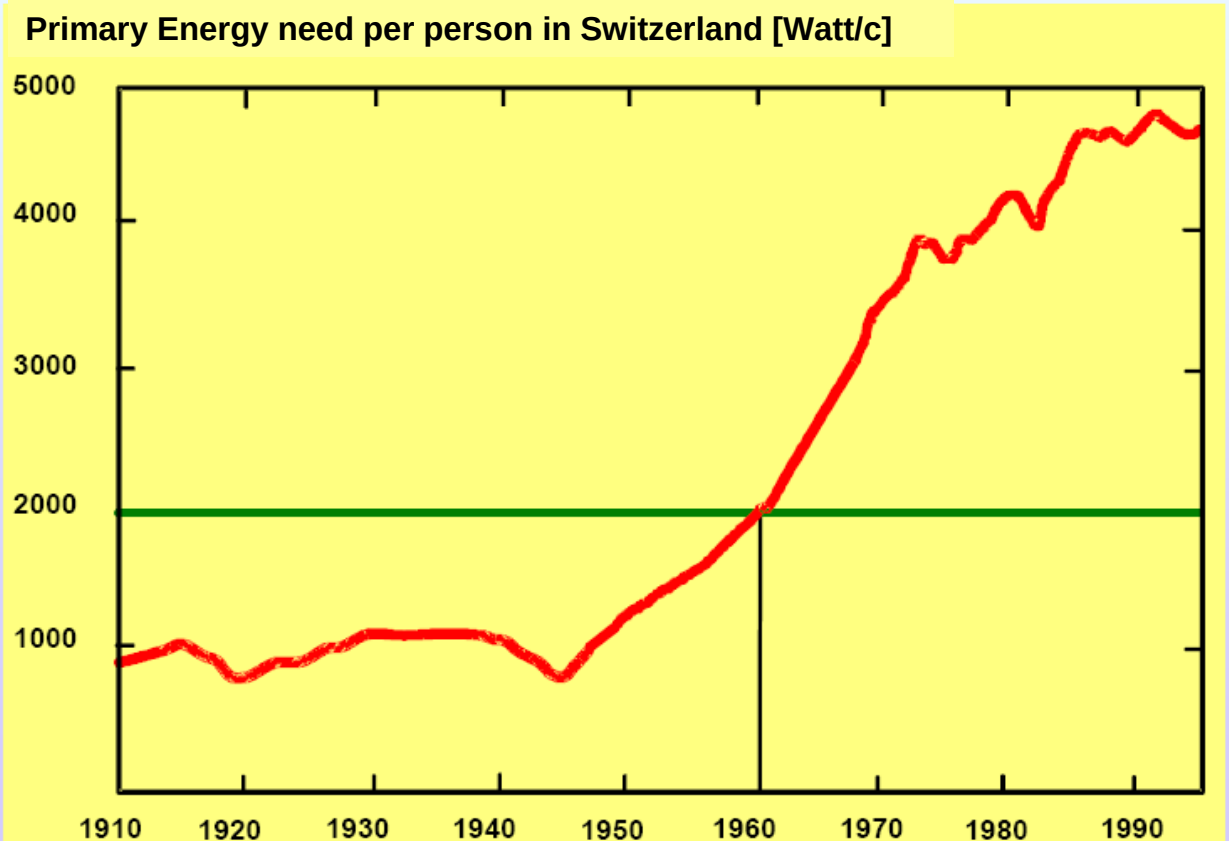
Only 500 W from non-renewable resources!!!!

Source: A.Binz, Impulse aus der Energieforschung, FH-BB

What can, what must be the focus, the objective?

The ETH Zurich strategy – The 2000-Watt-Society

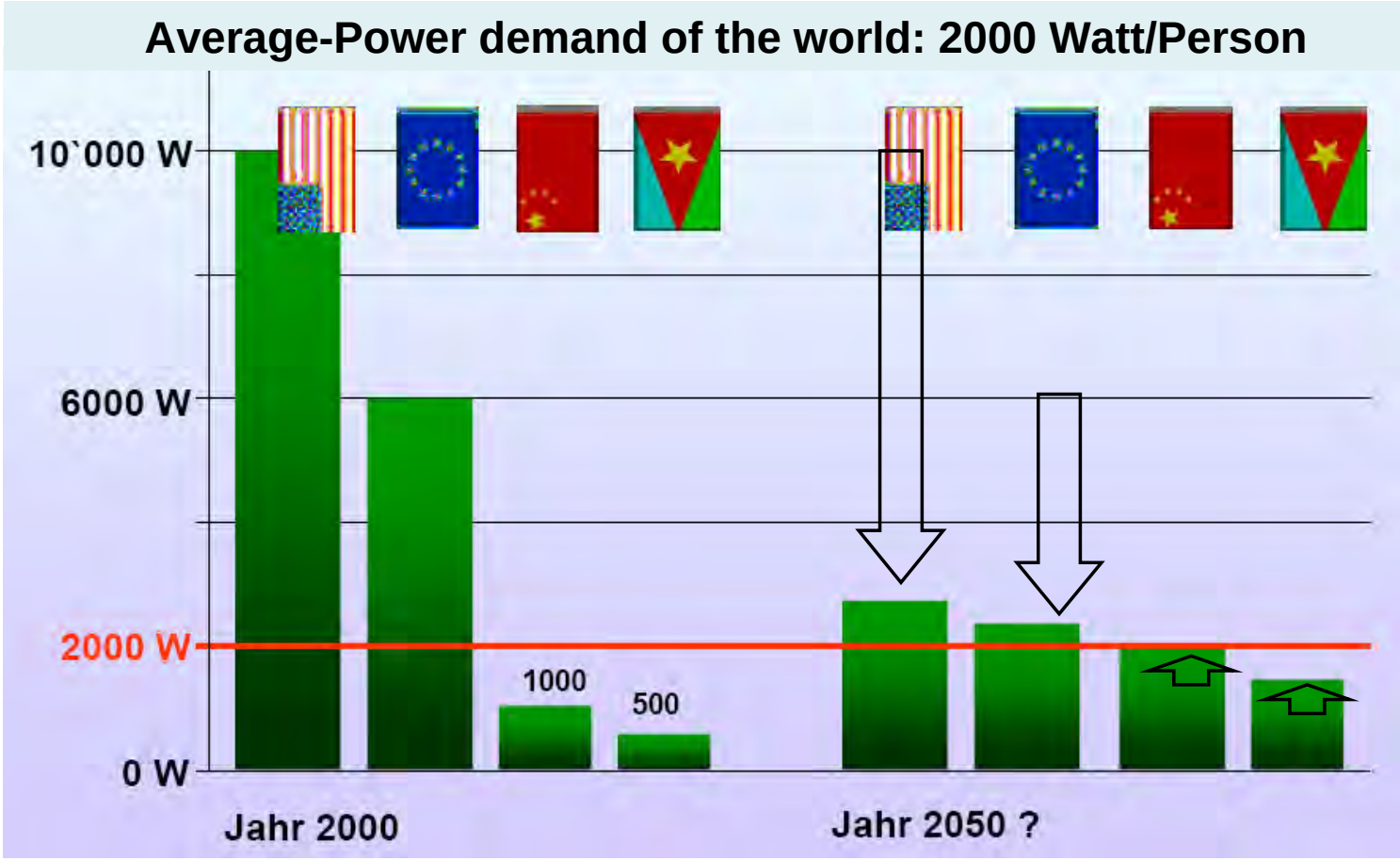
The 2000-Watt-Society = Need of Switzerland in 1960



Source: A.Binz, Impulse aus der Energieforschung, FH-BB

What can, what must be the focus, the objective?

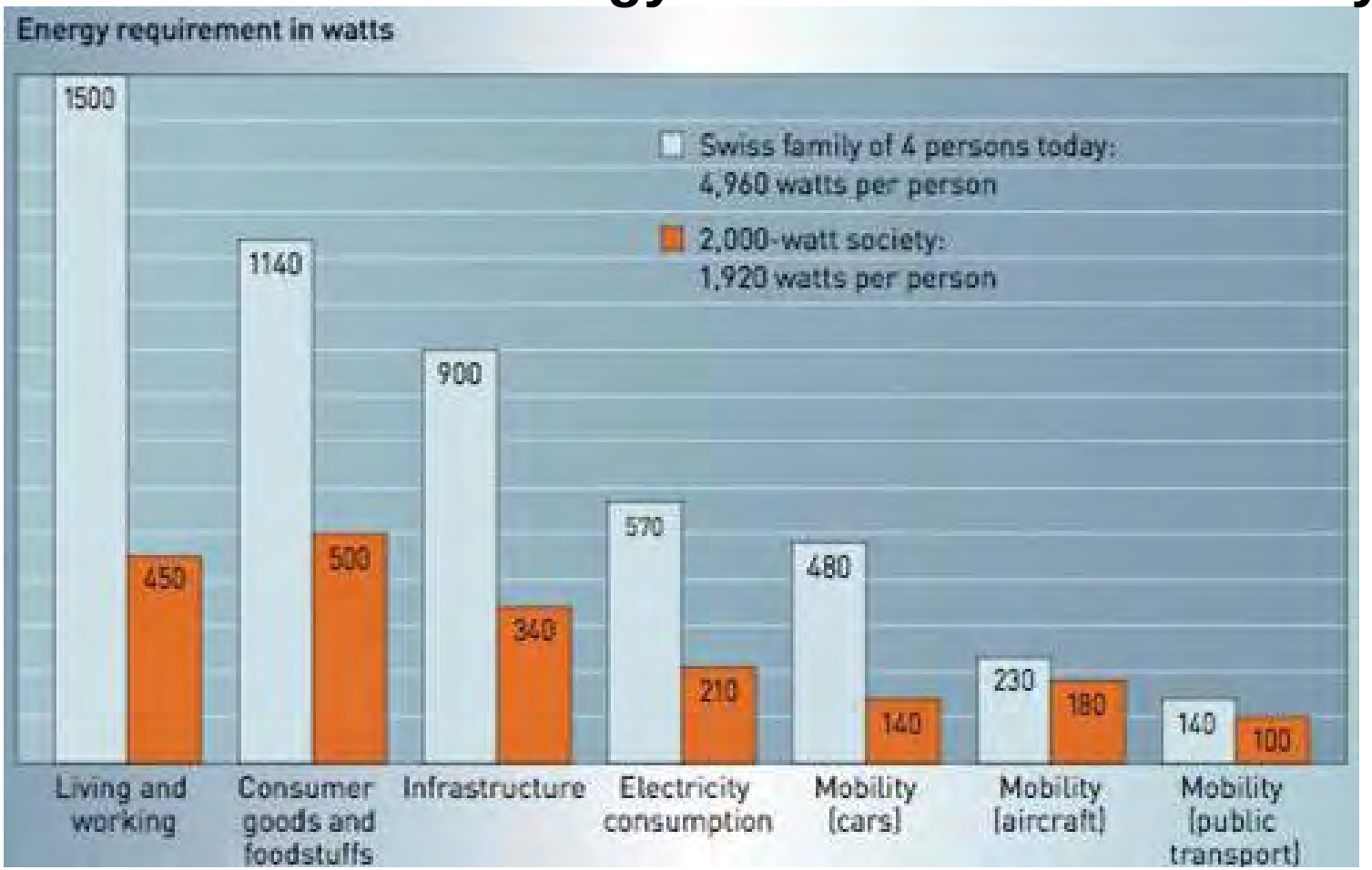
The ETH Zurich strategy – The 2000-Watt-Society



Source: FHBB Inst. f. Energie

What can, what must be the focus, the objective?

The ETH Zurich strategy – The 2000-Watt-Society



Source: FHBB Inst. f. Energie

CONSIDERATION NO. 10:

What can the strategy be?

What can the strategy be?

Energy Concept 1 - The Hummingbird

The extremely fast wing movements of the hummingbird consume an enormous amount of energy, so it also has a very high energy requirement and it must constantly find new energy sources or it will die.

Energy efficiency is a major principle of life and a successful evolutionary development.

Source: http://community.webshots.com/photo/97871133/97888752JcGKDM

What can the strategy be?

Energy Concept 2 - The Sloth

The long phases of sleep and the slow movements allow the sloth to consume very little energy. As a result its energy requirements are also very low.

Energy efficiency is a major principle of life and a successful evolutionary development.

Source: www.uni-ulm.de/~nwelling/CostaRica.html

What can the strategy be?

Energy Concept 3 - The Dolphin

The streamline-formed body of the dolphin enables it to move quickly with low energy consumption.
= energy efficient !
As a result it has a much more comfortable life.

Energy efficiency is a major principle of life and a successful evolutionary development.

Source: www.uni-ulm.de/~nwelling/CostaRica.html

What can the strategy be?

The strategy should be

Source: xxx

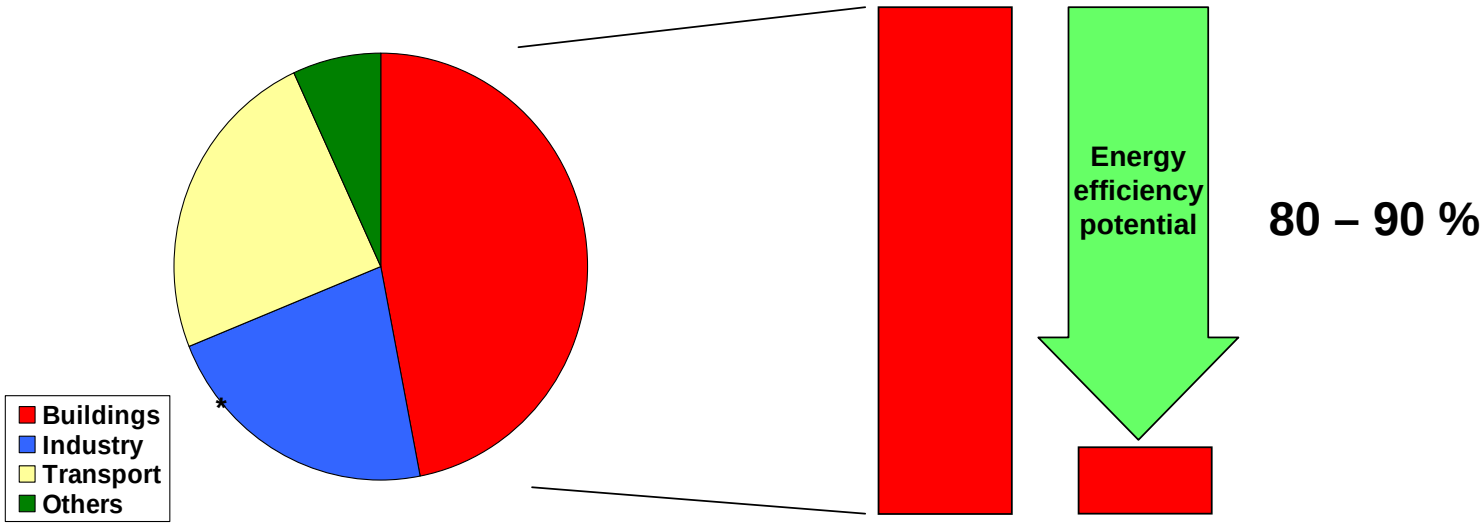
What can the strategy be?

Efficiency η = Output / Input

Efficiency is a major principle of life and a successful evolutionary development.

What can the strategy be?

The energy consumption of buildings



1. Enormous responsibility of all builders !

2. Goal => < 100 kWh/(m²a)

Specific primary energy demand for heating, warm water and electricity for buildings

*** Heating, Cooling, Domestic engineering**

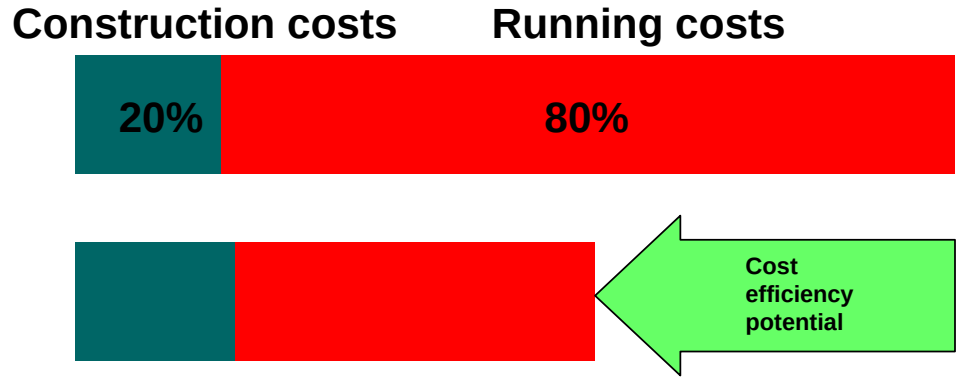
Source:

What can the strategy be?

The Cost Distribution of Buildings

Life cycle costs

- a building exists 80 years (or longer)
- construction costs are only 10 - 20 % of the total costs of the building



The effects of the decisions of all builders last longer than their personal life span!

Source:

What can the strategy be?

Therefore, in order to be suitable for the future, buildings of today must have

< 100 kWh/(m²a)
specific primary energy requirement.

+ out of Responsibility
  - environment-/climate protection
+ out of Solidarity
  - with the large part of mankind
  - with future generations
+ out of Self-interest
  - gain in comfort
  - low energy costs
  - **in order to be economically successful also in the future**

Source:

What can the strategy be?

Definition Passive House-Standard:

Spec. primary energy demand < 120 kWh/(m²a)

(Heating, Warm water, Electricity)

⇒ a comfortable indoor climate without a separate heating system
and without a separate cooling system

Annual heating demand < 15 kWh/(m²a)

=> the criteria of comfort must be reached in each room
in the winter and in summer

Heating load < 10 W/m²

Source:

What can the strategy be?

Definition Passive House-Standard + 2000 W – Society :

Spec. primary energy demand **< 100 kWh/(m²a)**

(Heating, Warm water, Electricity)

still more efficiency in the field of electricity!!!

⇒ a comfortable indoor climate without a separate heating system and without a separate cooling system

Annual heating demand **< 15 kWh/(m²a)**

⇒ the criteria of comfort must be reached in each room in the winter and in summer

Heating load **< 10 W/m²**

Source:

CONSIDERATION NO. 11:

What does that mean for architectural discussion?

Source:

What does that mean for architectural discussion?

What means this in the cultural view?

Source:

What does that mean for architectural discussion?

What is culture?

colere (=cultivate) > cultura > Culture

1. Cultivation (or care) of the environment

2. Care of the body

3. Care of the spirit

Source: http://de.wikipedia.org/wiki/Osterinsel

What does that mean for architectural discussion?

What is culture?

Easter Island

Moai sculptures

Destruction of their ecosystem by their own religion and culture !!!!

Is this culture ???

Source: http://de.wikipedia.org/wiki/Osterinsel

What does that mean for architectural discussion?

What is culture?

Earth

„Architectural“ sculptures
(Bad indoor conditions and a high energy need)

Is this culture ???

Source: http://de.wikipedia.org/wiki/Erde_%28Planet%29; http://members.eunet.at/heinz.redl/images/822-11.jpg

What does that mean for architectural discussion?

What is architecture?

„Architecture“ is the art and science of designing and constructing buildings.

Or better said:

The design of the whole human environment.

That means:

Construction + Culture = Architecture

Source:

What does that mean for architectural discussion?

What is architecture?

Construction without Culture

= no Architecture

and

Construction without care for the environment

= no Architecture (Culture)

Source:

What does that mean for architectural discussion?

What is architecture?

Construction with care for the environment in the 21st century

= very small or no energy need
(Passive-House-Standard or better)
= ecological construction (grey energy)
+ economic aspects
+ careful use of land
+ minimizing the causes of traffic
+ social aspects

Source:

What does that mean for architectural discussion?

Architecture in the 21st Century !!!

The quality of architecture can not be defined by technical values,

but

these few and so important values very well determine whether one can even speak of architecture!

Source: Feuerwache Heidelberg, Foto: Suhan; Montessori-Schule in Aufkirchen; Solar Decatlon, TU-Darmstadt

What does that mean for architectural discussion?

A win – win – win situation:

- for the user

- for the national economy

- for the environment

Source:

What does that mean for architectural discussion?

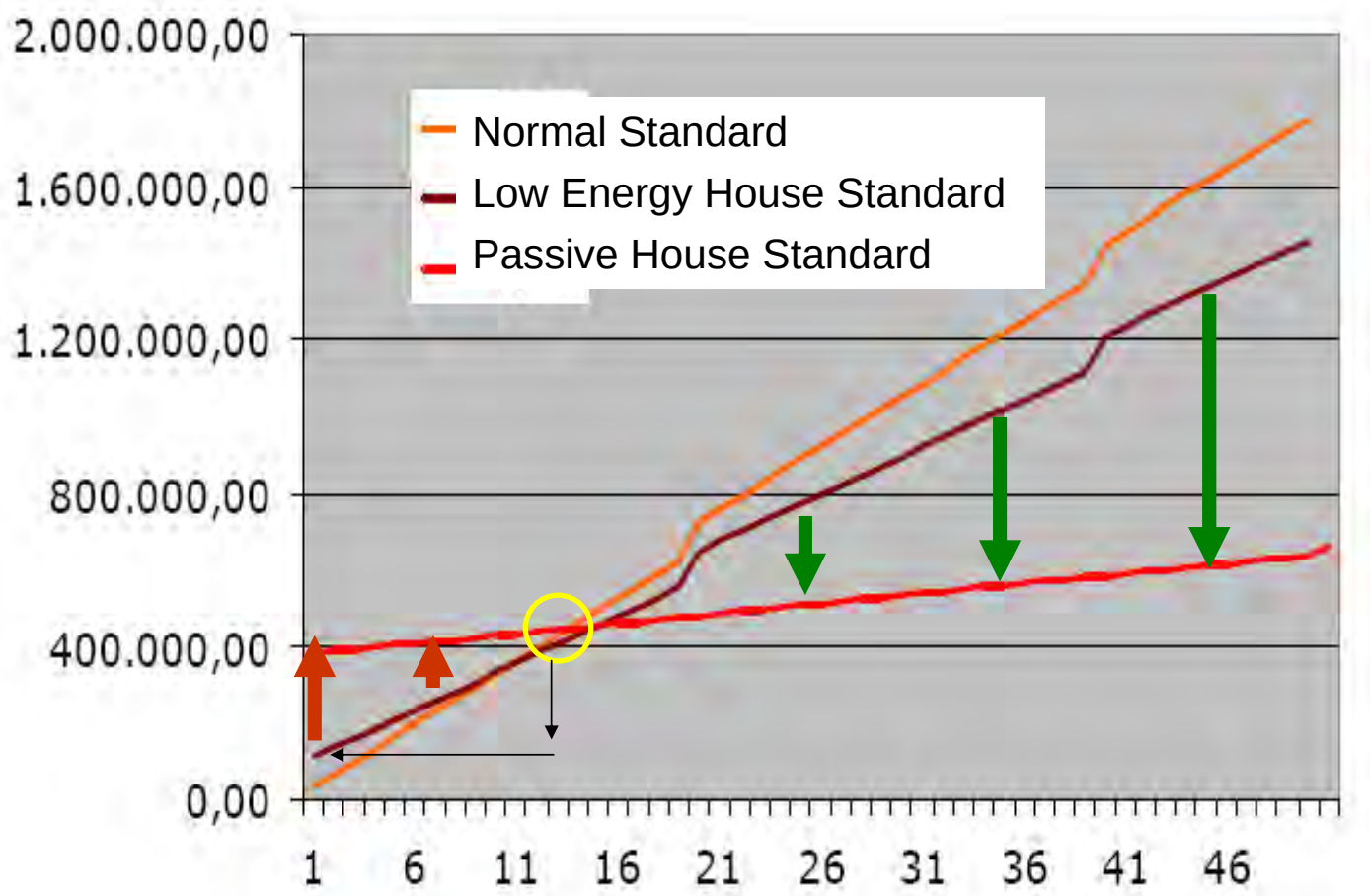
Some benefits of this:

- **Superior aspects**
  - Achieving energy independence
  - Security against crises
  - Sustainability
  - CO_2 – reduction
  - Creation of domestic assets and jobs
- **Economics**
  - Lowest running costs
  - Stable value
  - Energy pass (2006)
- **Living quality**
  - Thermal comfort (also in summer)
  - Air hygiene
  - Noise protection
  - User friendly

Source:

What does that mean for architectural discussion?

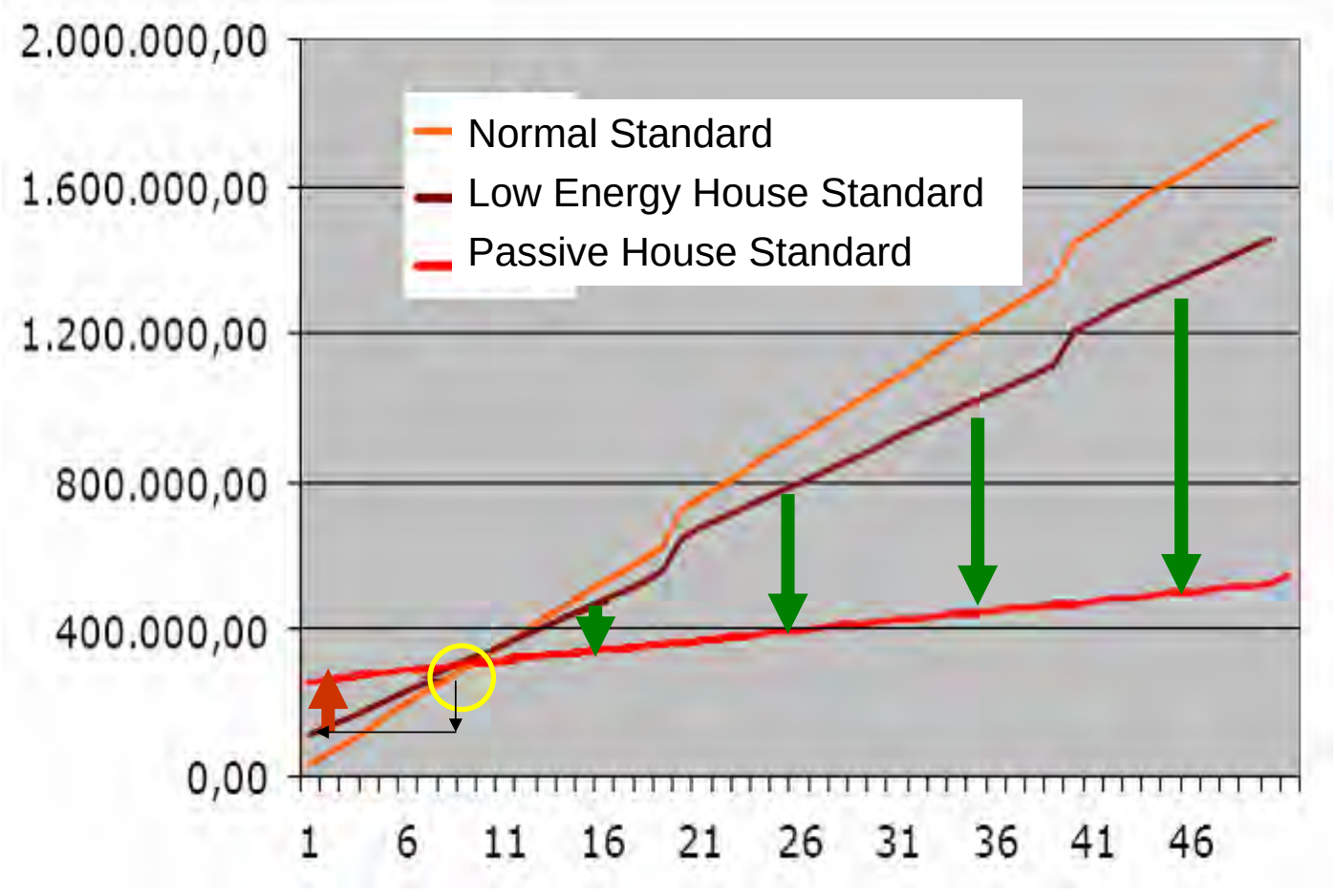
Future solutions > Life cycle costs



Source: HAUSER, L.K., „Optimierungsvarianten für die thermische Sanierung eines Wohnhochhauses“. Diplomarbeit - FH Technikum Kärnten, 2007, S 106

What does that mean for architectural discussion?

Future solutions > Life cycle costs



Source: HAUSER, L.K., „Optimierungsvarianten für die thermische Sanierung eines Wohnhochhauses“. Diplomarbeit - FH Technikum Kärnten, 2007, S 106

What does that mean for architectural discussion?

FUTURE SOLUTIONS

- NOW!

Source: