可持續設計?
為何與如何

Design for Sustainability:
Why and How ?

Environment and Climate Change Forum Series

CUHK Jockey Club Initiative Gaia

prepared by benny ding leong . School of Design . Hong Kong Polytechnic University . 30-10-2015

可持續?

Sustainability?

*What is our **major** challenges?*

- **Environmental Pollution**

  toxic / pollutants release

- **Resource depletion**

  Over use of water, food, etc.

- **Global warming**

  Climate change, drought/ flooding, diseases, etc.

可持續的主要挑戰?

*the **3 major** challenges…….*

- **Environmental Pollution**

  *toxic / pollutants release (**Local, Regional**)*

- **Resource depletion**

  *Over use of water, food, etc. (**Local, Regional**)*

- **Global warming**

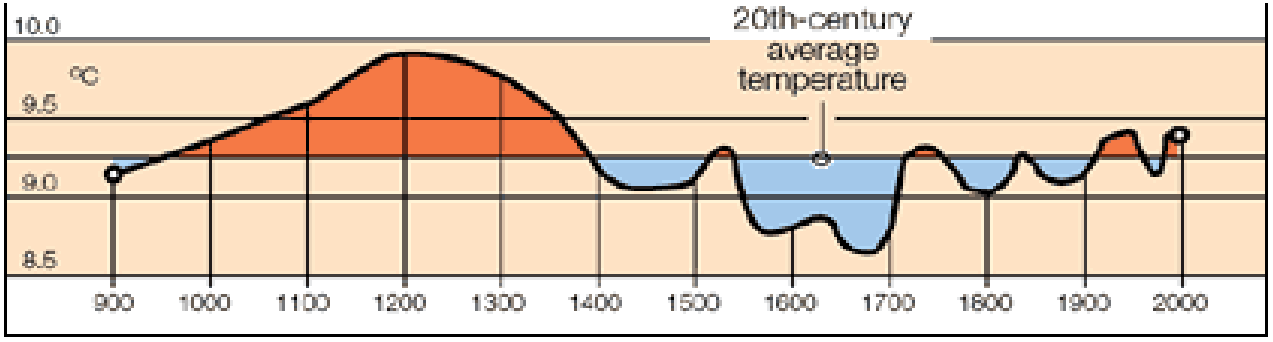
*Climate change, drought/ flooding, diseases, (**Global** -- concerns of all people, countries of the whole world)*

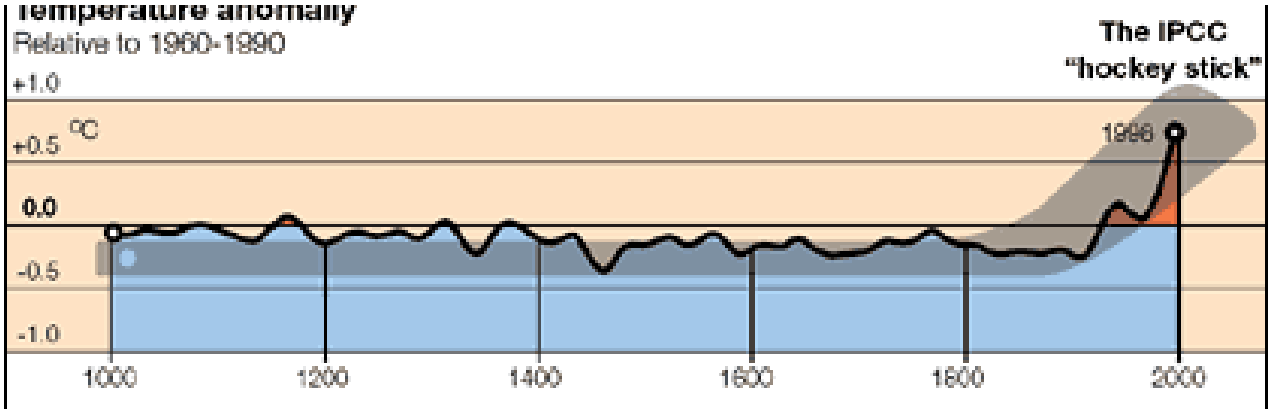
some scientists and politicians argue that ***human activity is NOT the cause*** of global warming !

Medieval time is **warmer than today**….

(False Alarm, Paul MacRae, 2008)

Intergovernmental Panel on Climate Change (IPCC) Report, **1996**

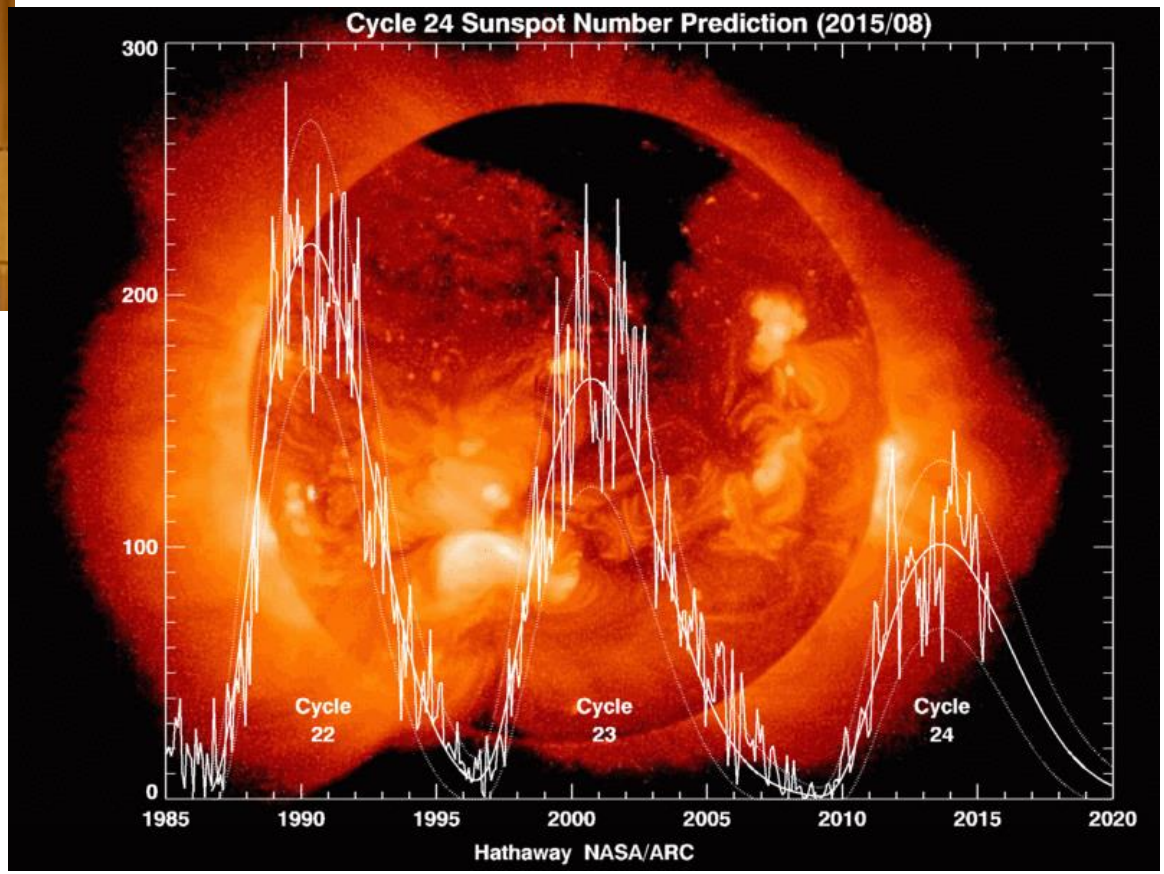




the revised graph within the IPCC Report, **2001**

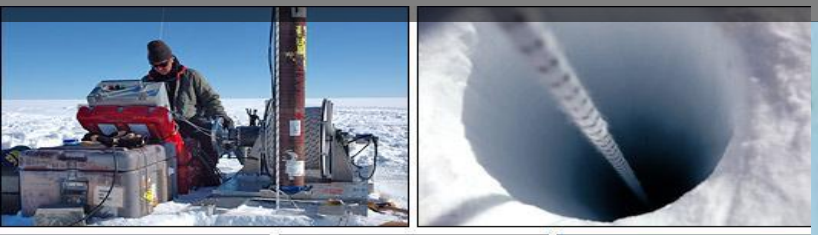
because of solar magnetic activity cycle!

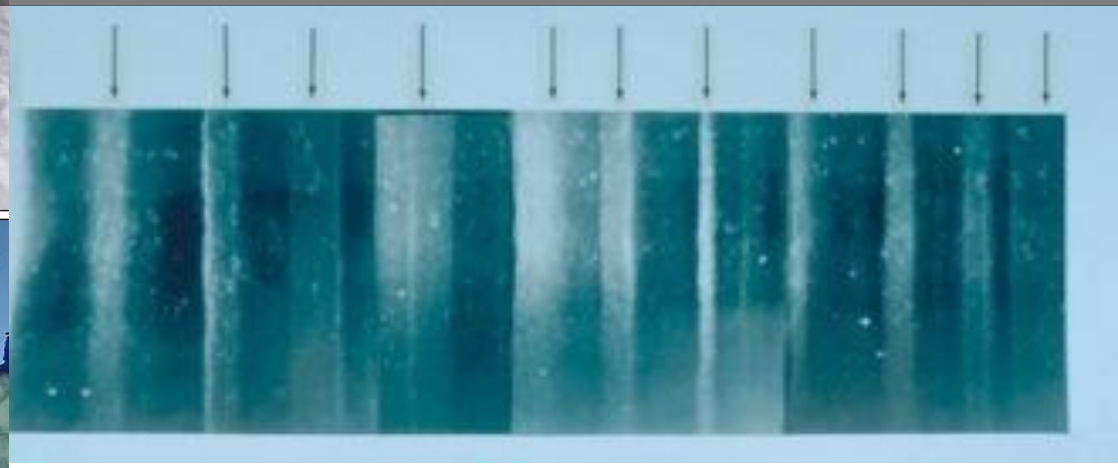
紐特・金里奇

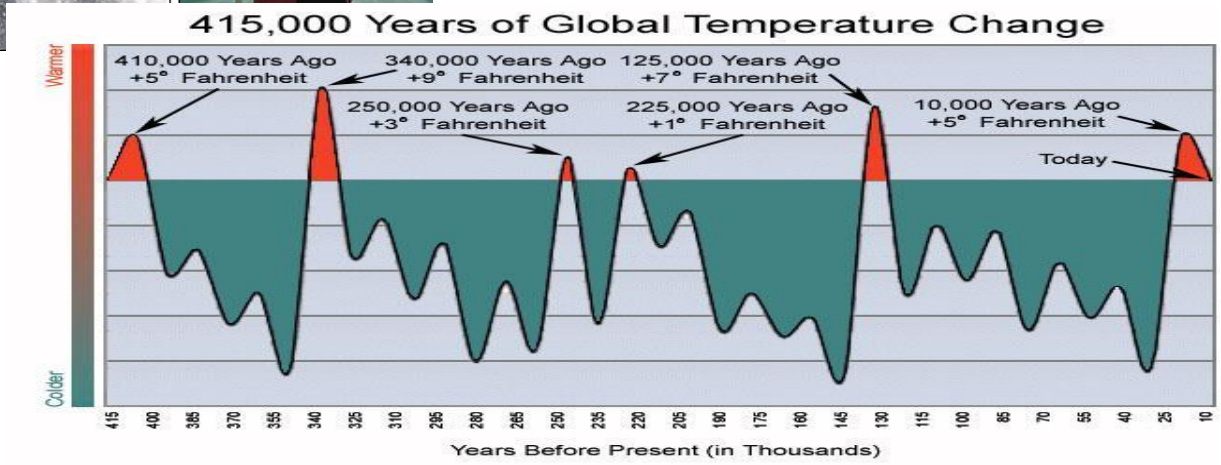


The **solar magnetic activity cycle**（太陽磁場活動週期） is the nearly periodic 11 year change in the Sun's activity (including changes in the levels of solar radiation and ejection of solar material) and appearance (changes in the number of sunspots, flares and other manifestations)

climate change records of **415 thousand years**…..



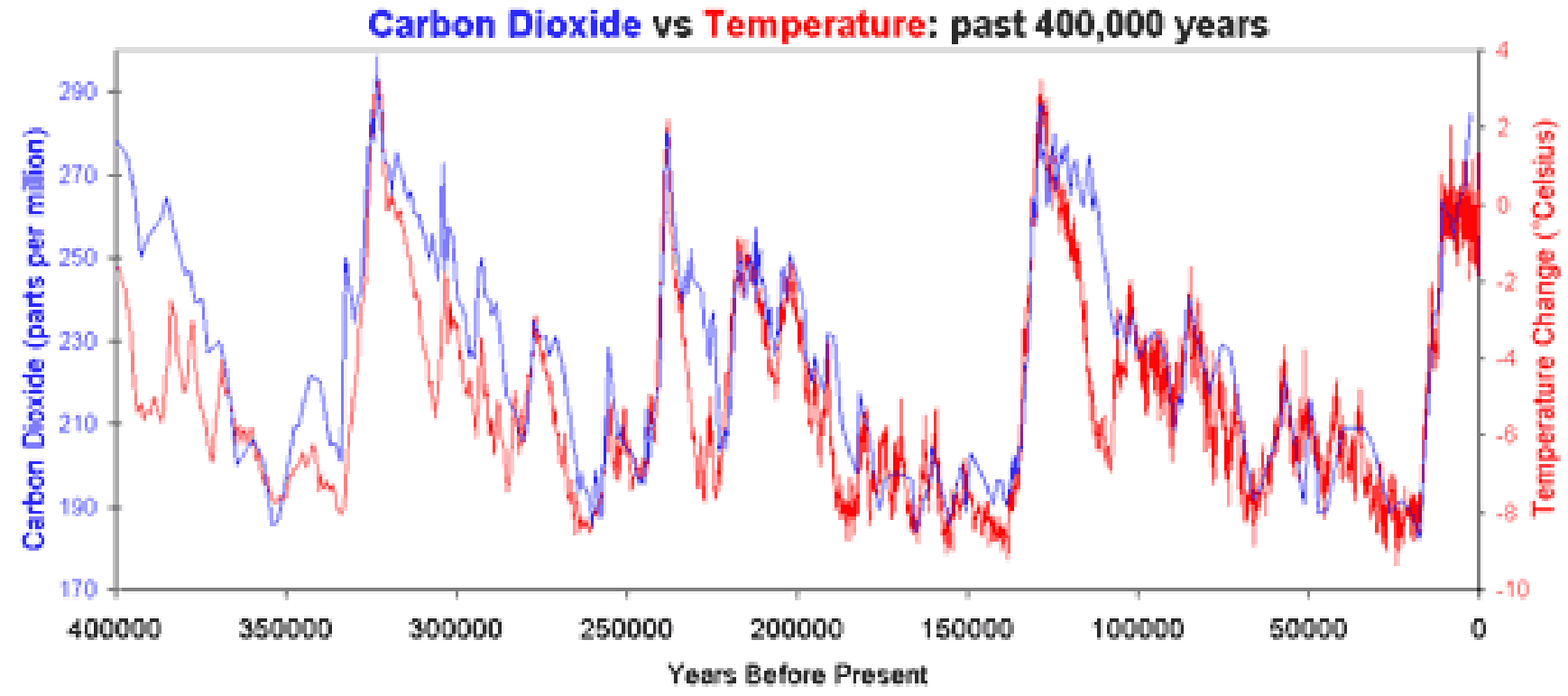




Ice core samples removed from an ice sheet, most commonly from the polar ice caps of ***Antarctica***, ***Greenland*** or from high mountain glaciers elsewhere.

Co2 lags Temperature

(Skeptical Science, 2011)



CO2 levels move up and down **AFTER** the temperature has done so, thus are the **RESULT OF, NOT THE CAUSE** of warming.

Greatest Co2 producer?

37,400 bn tons Co2 (三十七萬億噸)

Co2 is water dissolvable. Hence ocean is the biggest absorber of Co2. When temperature is cooler, the dissolvable rate of Co2 into the ocean is higher and visa-versa. **A warmer ocean will urge it to release Co2 into the atmosphere.**

Greatest Co2 producer?

the Atmosphere

720 bn tons (七千二百億噸)

2,000 - 3,000 bn tons (二/三萬億噸)

Land biomass

Greatest Co2 producer?

e.g. Human industrial activities

6 - 6.5 billon ton**s (**六十五億噸**)**

But, sustainability is **more than a matter of Co2** !!

Let’s look at an example.
A type of
***favourite food*……**

tuna sushi……

Sustainability?

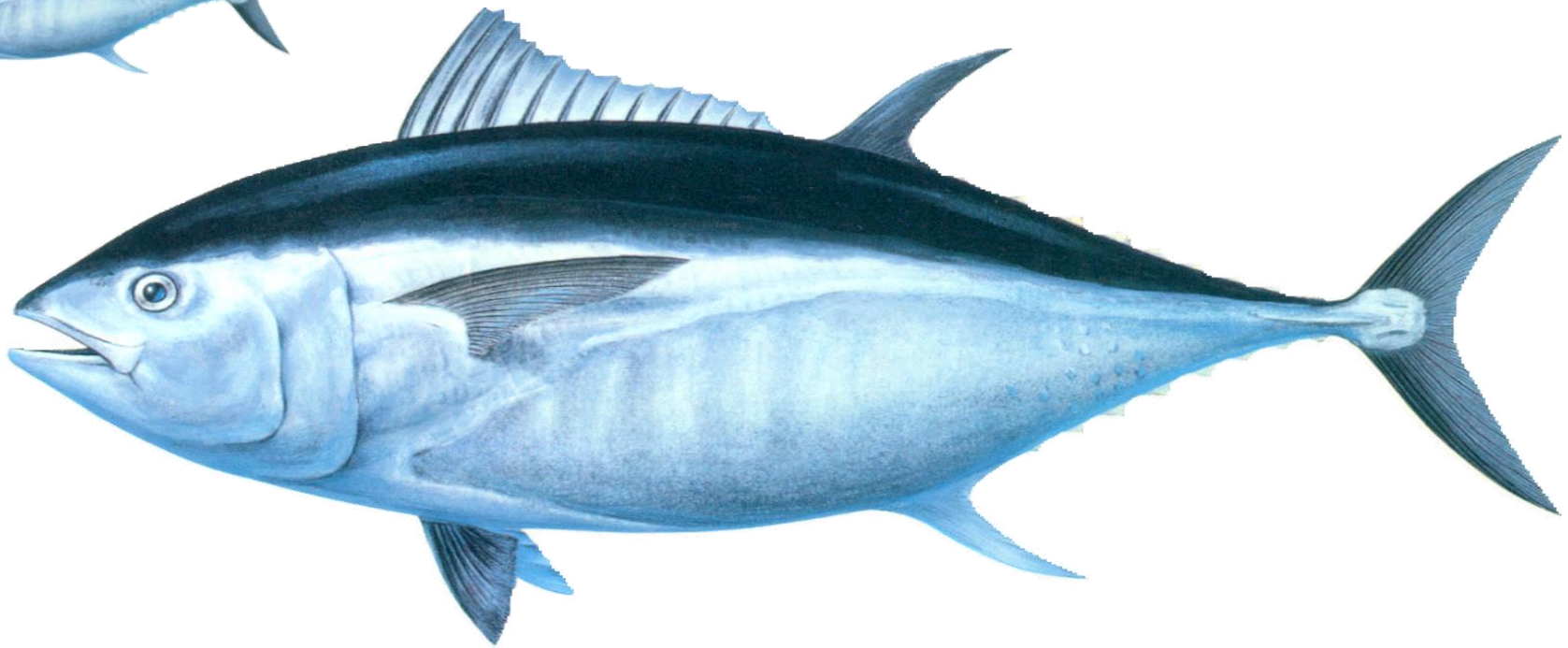
bluefin tuna – rare catch today!

550 lb

15-20 yrs

300 lb

489 lb

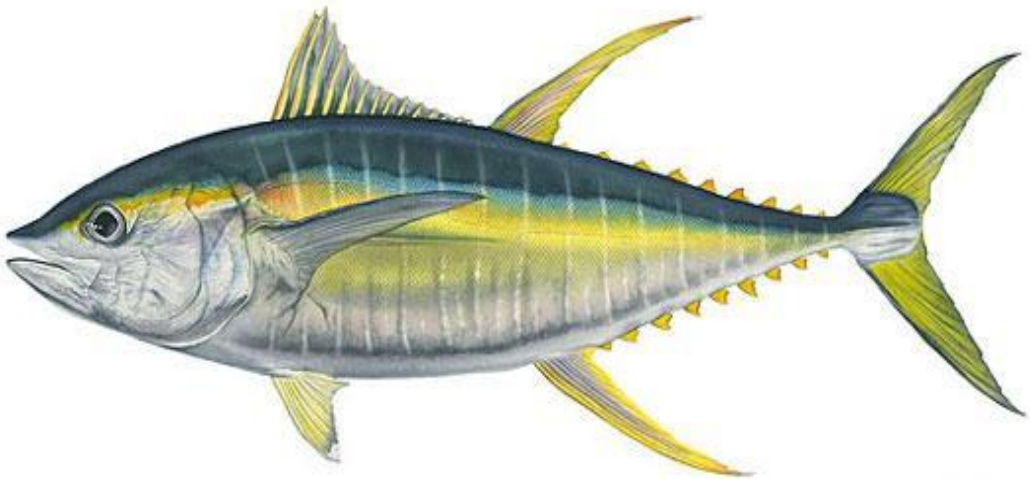


Sustainability?

Yellowfin tuna – HK$ 3,090 @ fish

180 lb

4-7 yrs

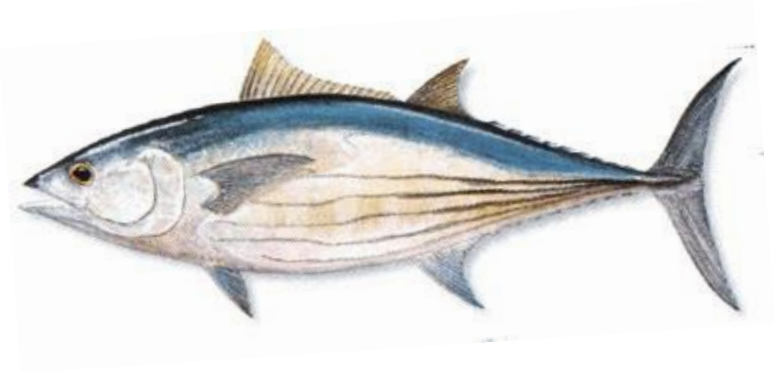


Sustainability?

Skipjack tuna – HK$ 600 @ fish

77 lb

1-2 yrs

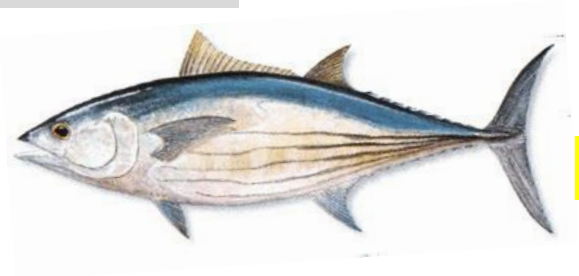


"chicken of the seas"

Sustainability?

unrestrained consumption…….

HK$ **600**



HK$ **3090**

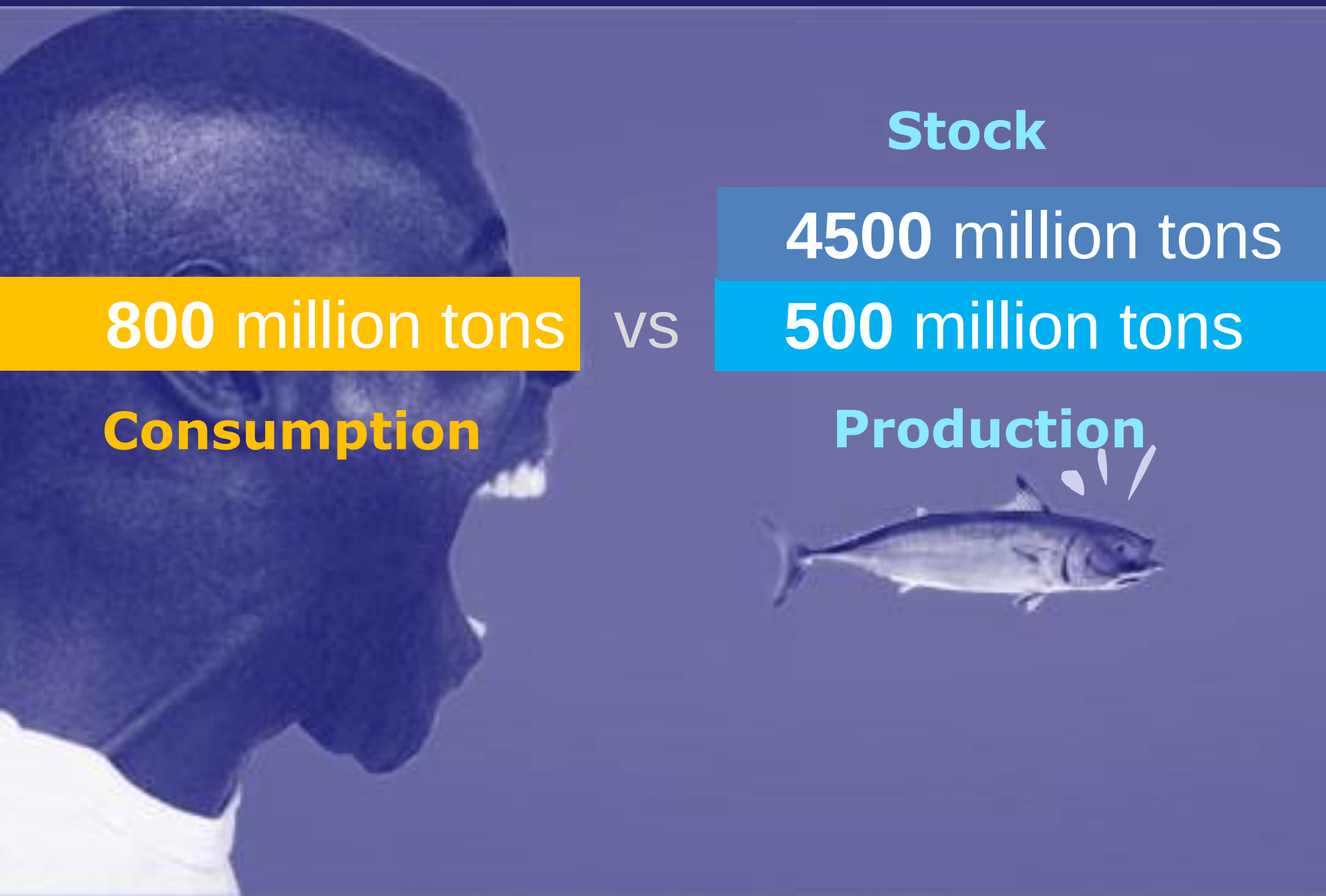
HK$ **13.6 millions**

800 million tons been caught yearly

In **few years** time tuna fishes will drop under the critical mass……

Source: BBC

Sustainability?



Sustainability?

- Around 85% of global fish stocks are over-exploited, depleted, fully exploited or in recovery from exploitation. *(Vince, Smart Planet 2012)*
- **Rise of global *food prices***

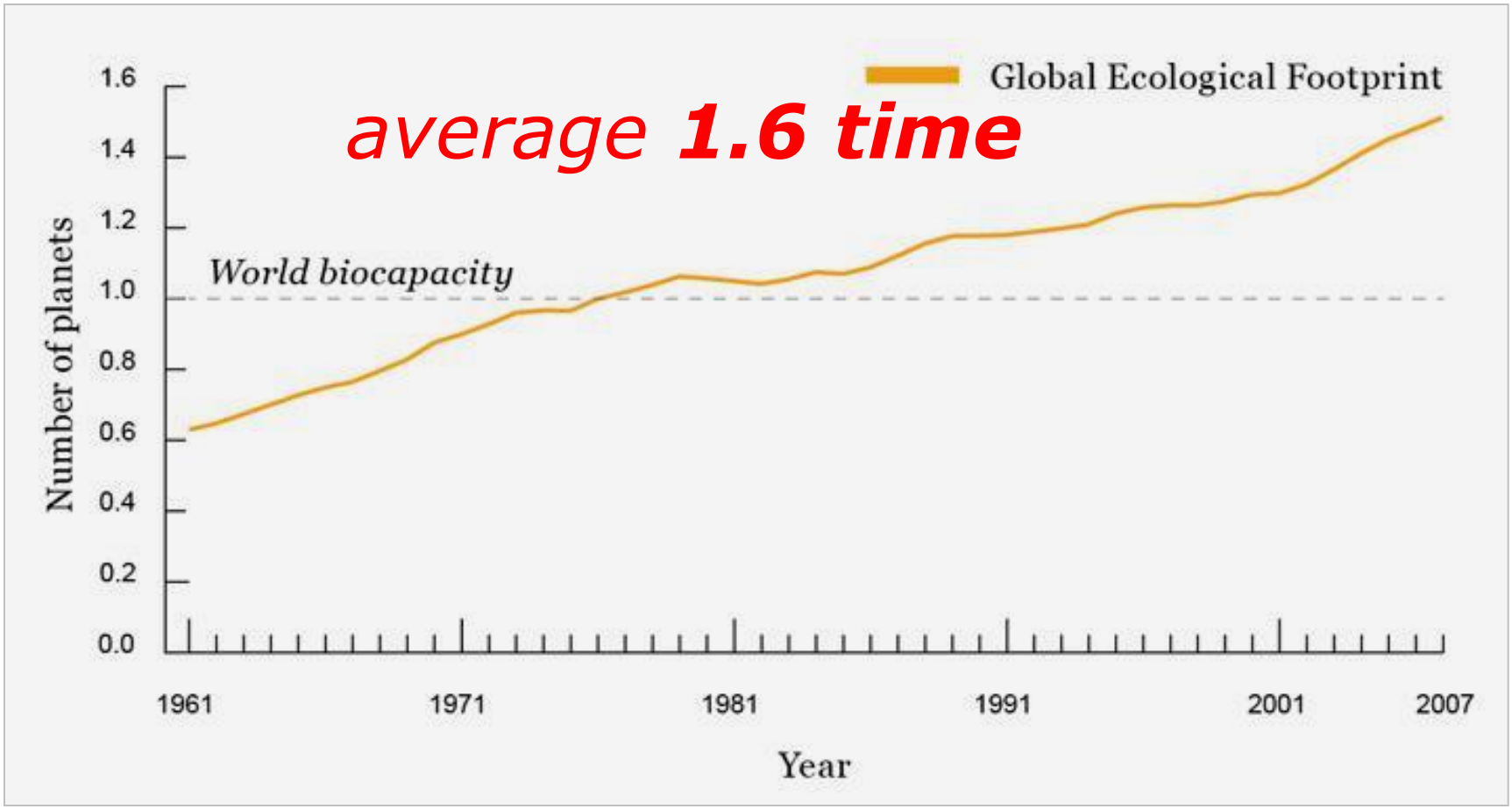
wheat → 58% (18%); corn → 87% (12%) *in 2011 (2014)*

this is

UNSUSTAINABLE!

we've ***overloaded*** the biocapacity……

2.7 @ capita vs **1.8 gha** (全球公頃)!



Global Ecological Footprint 全球生態足印 (Global Footprint Network, 2010)

the one which should ***concern us MOST*** *!*

- **Environmental Pollution**

  *toxic / pollutants release (**Local, Regional**)*

- **Resource depletion**

  *Over consumption of water, food, etc. (not local but **GLOBAL !!**)*

- **Global warming**

  *Climate change, drought/ flooding, diseases, (**Global** -- concerns of all people, countries of the whole world)*

by 2050.....

about **9 billion** people on Earth !!

sustainability has to ground on

carrying capacity 承載能力!

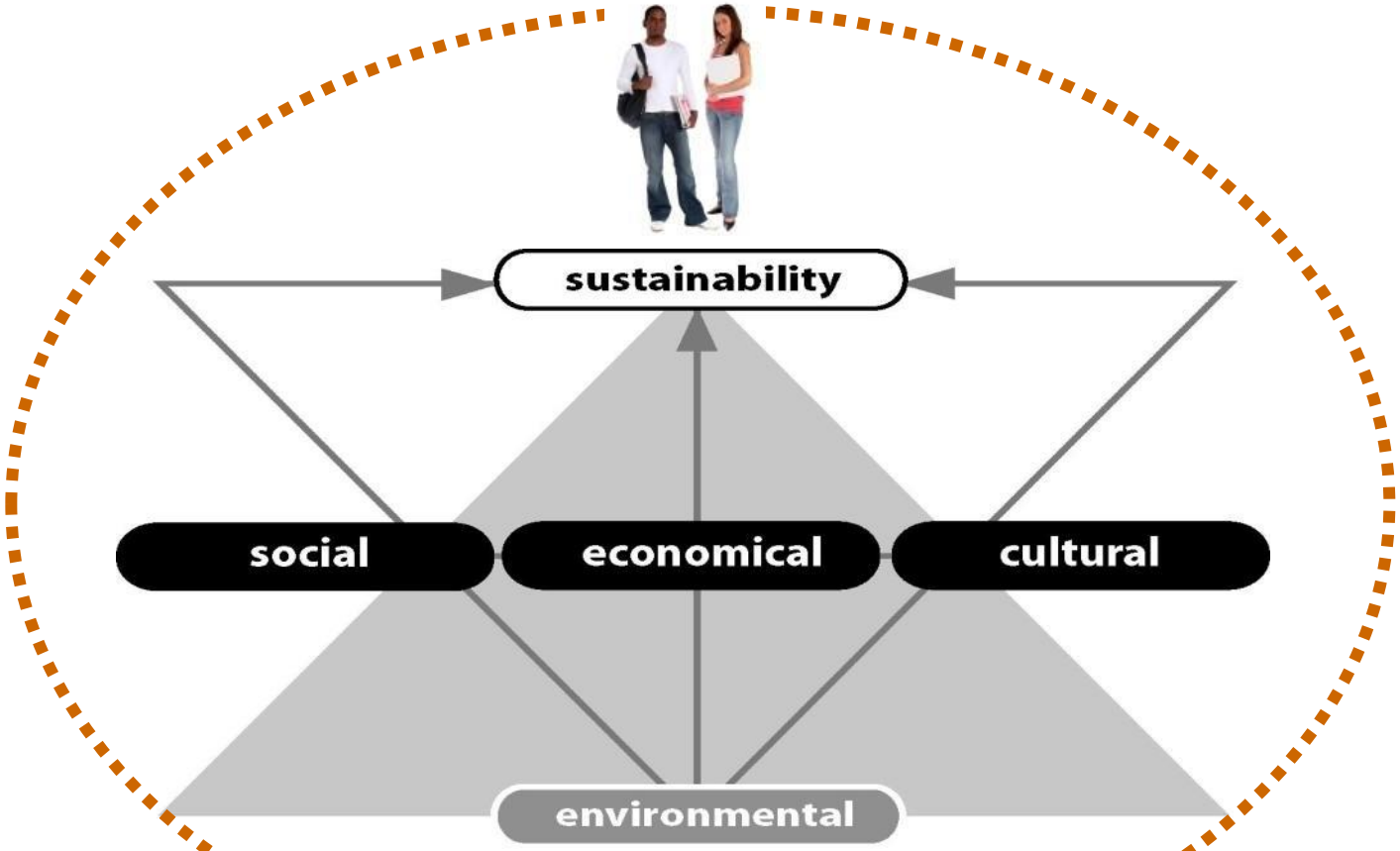
of our PLANET !

Sustainability?

OVER or **MISUSE** of ecological resource?

unsustainable development !

Sustainability?



ecology

為何
WHY?

Design
for Sustainability ?

1

可依靠科技嗎?
Technology?

a

It will take ***20 to 30 years*** for innovative technologies to ***reach wide use !*** *(Rau et al., 2010)*

Harvard Business Review（哈佛商業評論）

b stimulates an ***expected problem***!

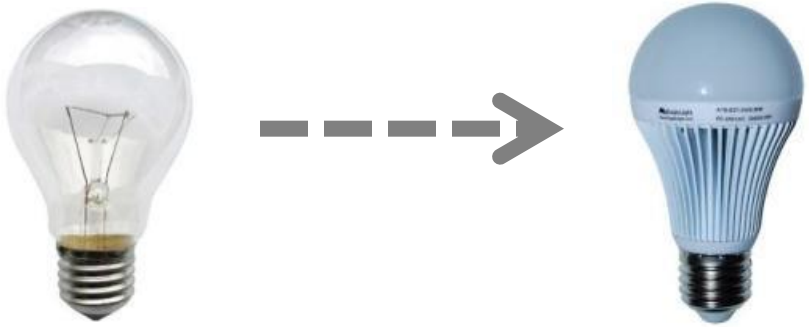
Efficiency

Design for **efficiency** (能效設計)

Production

DfE *Design for Environment*

1 **procurement** 2 **manufacturing** **use** 3 **disposal** 4



Incandescent ***LED***

increase efficiency?

	LED	Incandescent
Light bulb projected lifespan	50,000 hours	1,200 hours
Watts per bulb (equiv. 60 watts)	10	60
[redacted]		
KWh of electricity used over 50,000 hours	500	3000
[redacted]		
Total cost for 50k hours	$85.75	$352.50

increase efficiency → **USE MORE !!**

light pollution 光污染

Look! in term of water consumption in the **United Arab Emirates** 阿聯酋….

Abu Dhabi *Golf Course*

Dubai (United Arab Emirates), Creek Golf Club

On a per capita basis the *United Arab Emirates* **consume 83% more water** than the global average, and about **6 times more water** than the U.K. *(Booz & Company, 2012)*

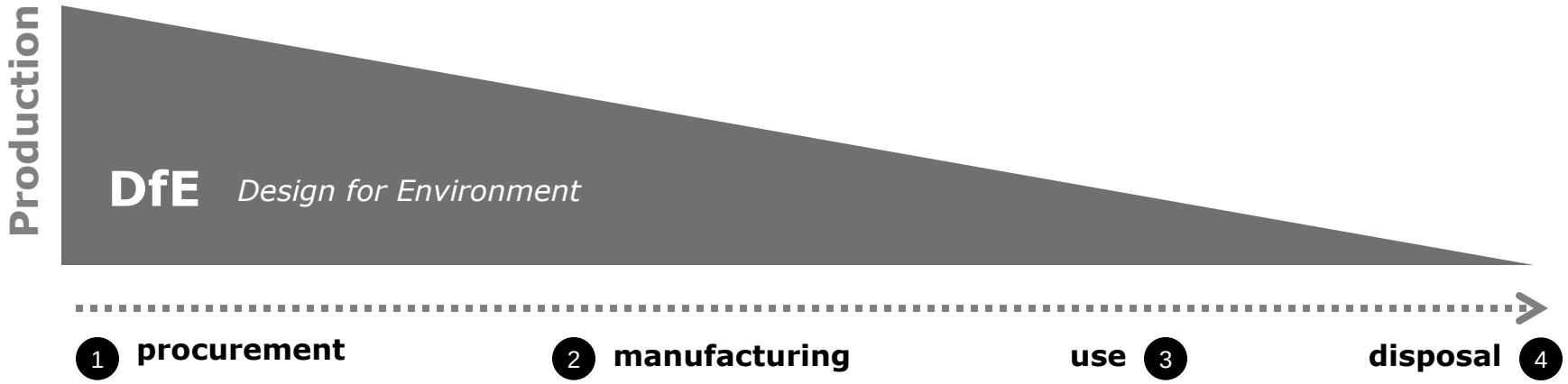
Look! in term of water consumption in the **United Arab Emirates….**

A desalination plant in GCC

Desalination provides two-thirds or more of the potable water used in the UAE.

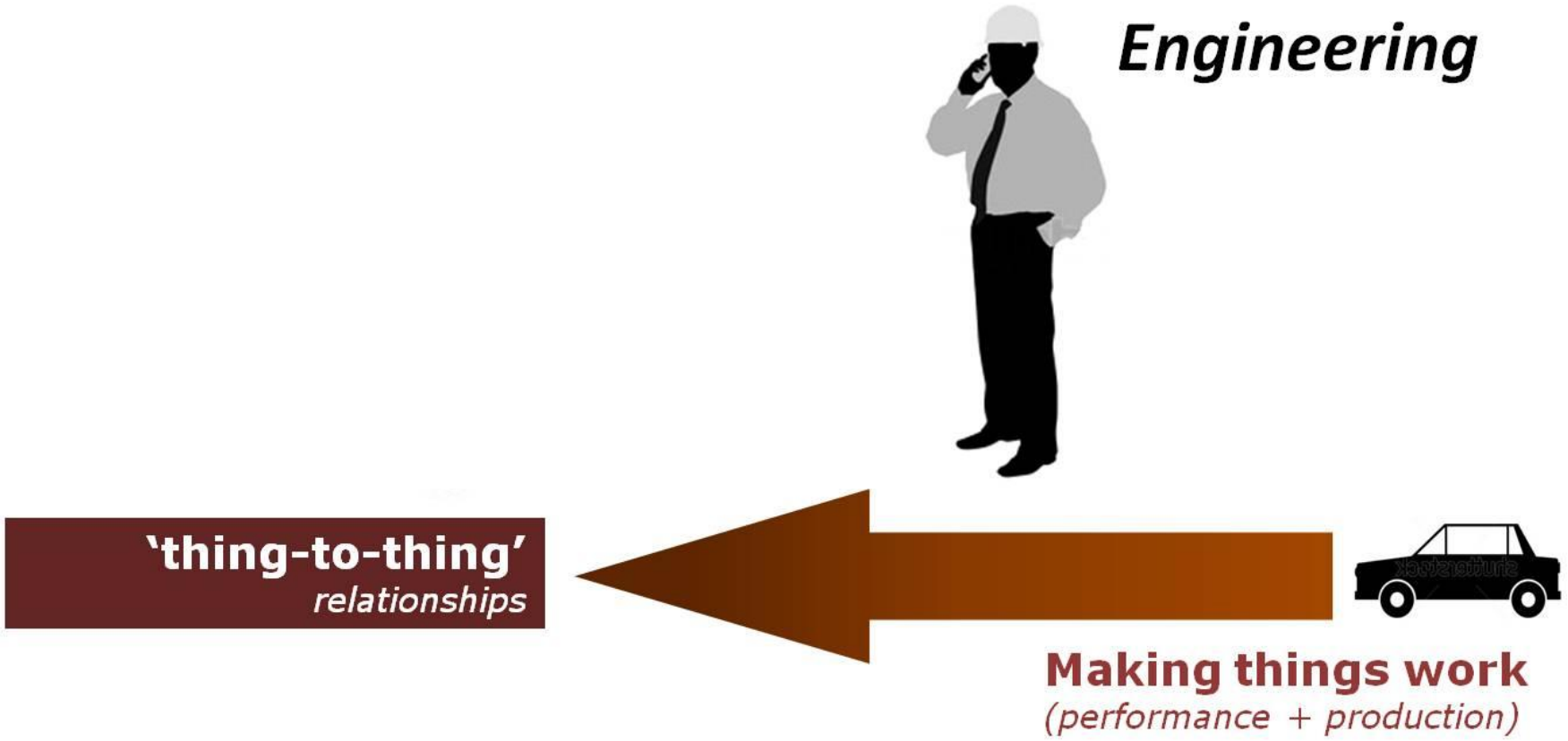
Over *50-70%* of production resources and ***90%*** of products were ***trashed within ½ or a year time.*** *(Datschefski, 2001, Kanniah, 2002; Knight, 2009)*

stimulates an ***expected problem***!



Rebound effect !

technology make things work, ***but <u>NOT</u> people***!



there is another **problem** !

i ***mental rebound***

Eco-friendlier products are ***less guilt*** *to own* and use hence invite people to buy and use more.

Rebound effect !

there is another **problem** !

ii ***rebound of gain***

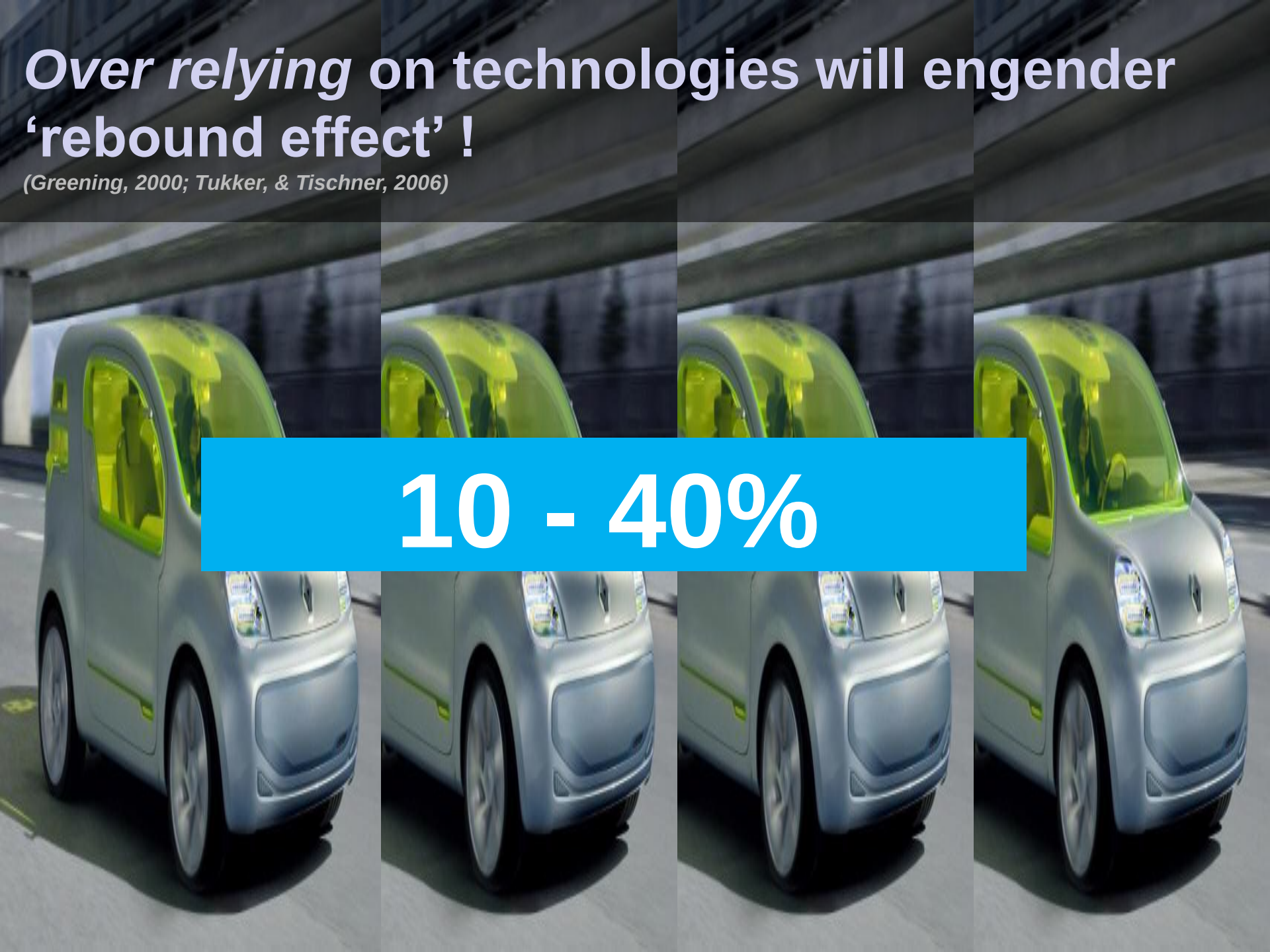
Energy efficient products drastically *reduce cost of ownership or utilization* hence invite people to buy or use more.

Various type of rebound effect: **Direct / Secondary/ Economy-wide/ Transformational

Rebound effect !

Over relying on technologies will engender ‘rebound effect’ !

(Greening, 2000; Tukker, & Tischner, 2006)



10 - 40%

Over relying on technologies will engender 'rebound effect' !

(Greening, 2000; Tukker, & Tischner, 2006)

more

consumption!

What can we do ?

2

設計?

Design ?

*What is **DESIGN** ?*

Needs of People
(human factors + interfacing)

'thing-to-people'
relationships

'Design'

Engineering

'thing-to-thing'
relationships

Making things work
(performance + production)

DESIGN	ARTS
work objectively with objective goal	• work subjectively : self expression
work for others	• work for themselves /individual client
with others (teamwork driven)	• solo performance led
use range of design/ planning tools	• intuitive/ personal developed skills

(adapted from Owen, 2004)

*The **3 cultures of knowing** in education:*

Nigel Cross (1982)

人文學科

HUMANITIES:
languages, arts, literature, philosophy, religion, history, anthropology, cultural studies, law and linguistics.

1st culture

science

humanities

design

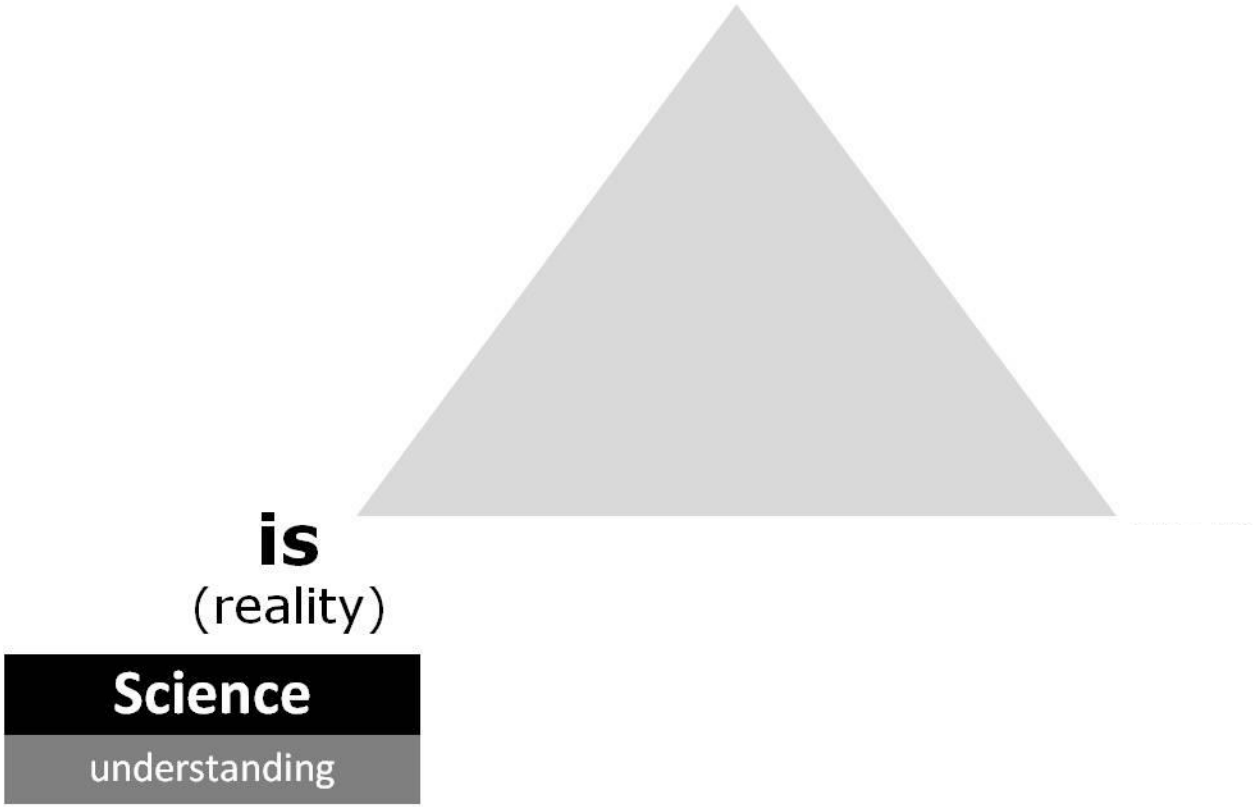
2nd culture

3rd culture

*Destin has a **higher purpose**…….*

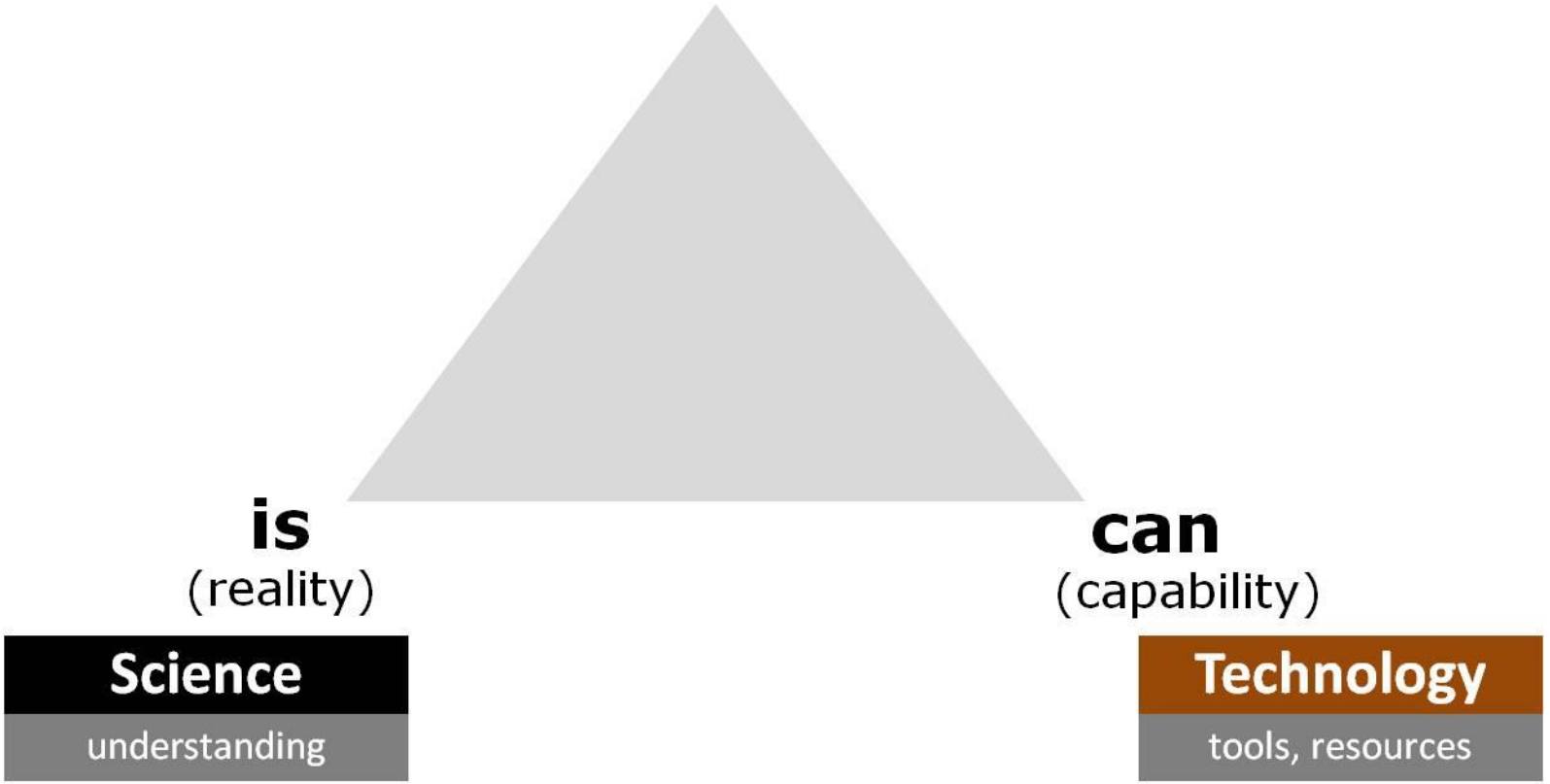
‘the 3 poles & space of rationality’ (Herny Woo, 1995)

*Destin has a **higher purpose**…….*



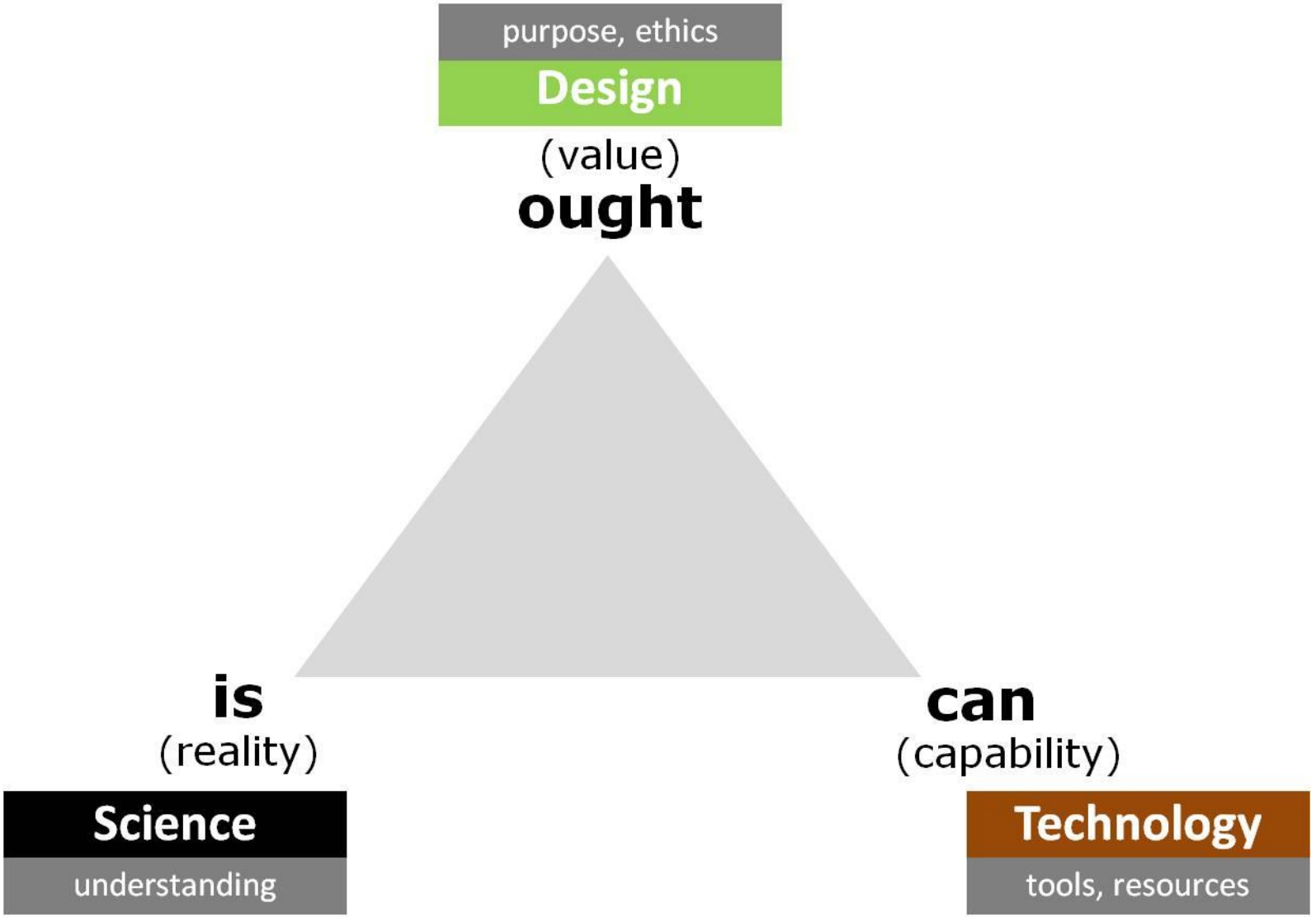
'the 3 poles & space of rationality' (Herny Woo, 1995)

*Destin has a **higher purpose**…….*



'the 3 poles & space of rationality' (Herny Woo, 1995)

*Destin has a **higher purpose**…….*



'the 3 poles & space of rationality' (Herny Woo, 1995)

如何
HOW?

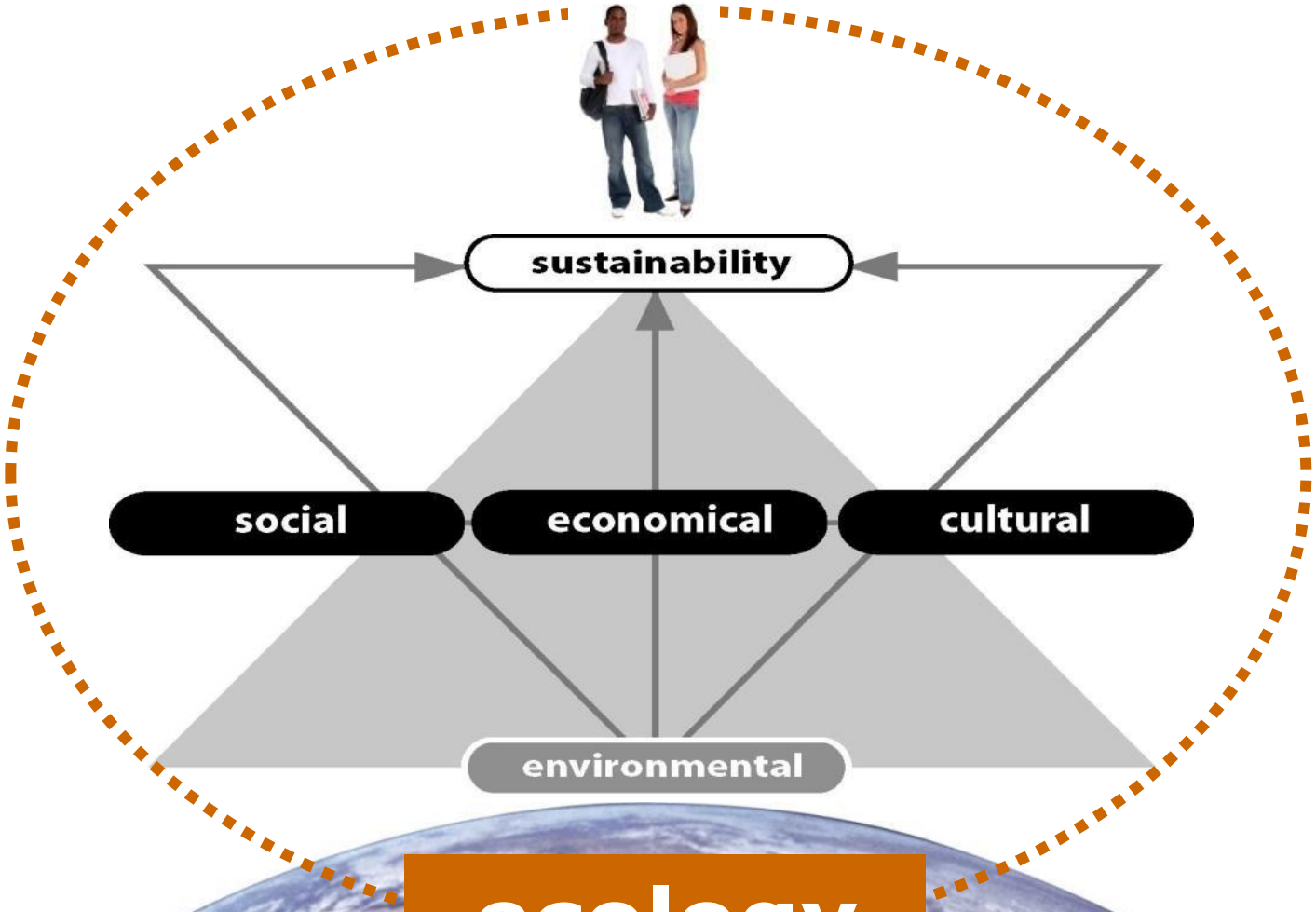
1

可持續設計!
Design for Sustainability !

i) **Product** Design for Sustainability

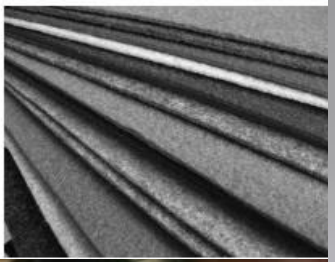
ii) **System** Design for Sustainability

Product /System Design for Sustainability



ecology

i) **Product** Design for Sustainability



整個產品都是由香港的避護工場制造和組裝，這不單帶給他們的一個工作機會，亦可以給社會知道他們不單只可以做一些低技術工作，其實也能生產一些有質素和有意義的產品。

i) **Product** Design for Sustainability

本地很多技術人材, 因為工廠北移而失去原本的工作，故需要不同的創新企業，以提供本地的技術人材盡展所長的機會。

ALDL

ecols

MEGAMAN®

SDWORKS

i) **Product** Design for Sustainability

i) **Product** Design for Sustainability

ii) **System** Design for Sustainability

‘function’ based and……

‘solution’ or ‘satisfaction’ driven !

(Manzini 2000; Vezzoli, 2007)

(Michman, 1991: 6)

Limit to Growth: 30 years update
(Meadows, Meadows, Randers, 2006)

Example: (1)

washing machines --> clean clothes

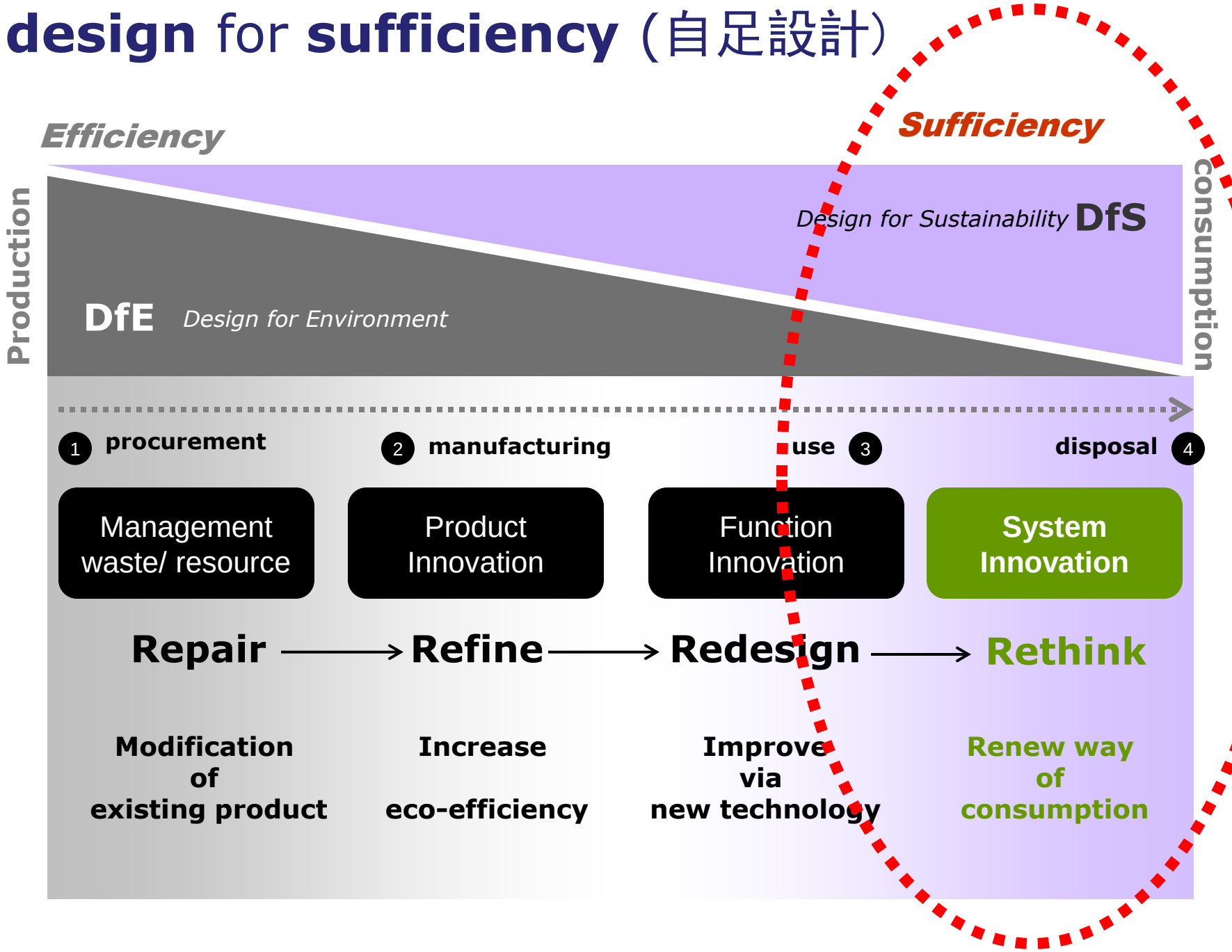
Example: (2)

automobile --> **mobility**

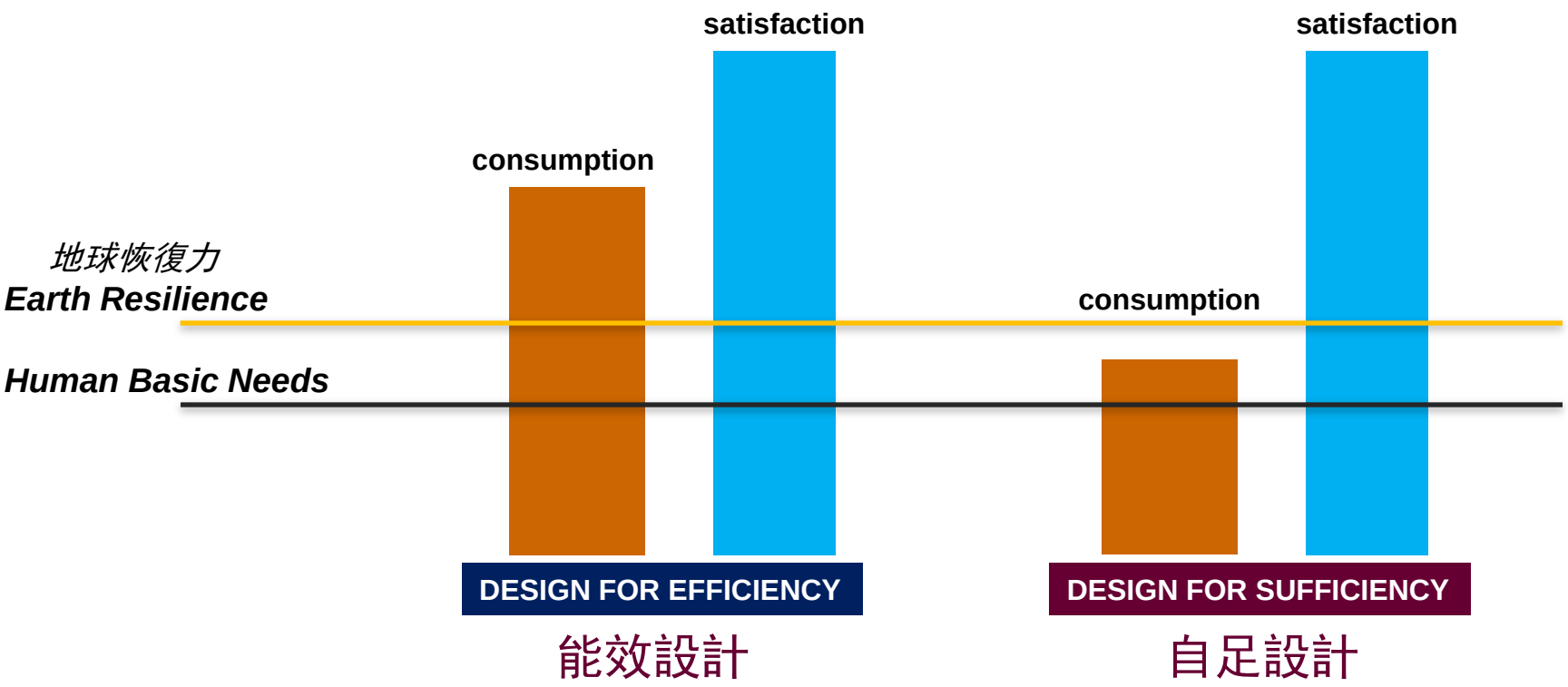
a result oriented offer which enable a person to get something done *and satisfy his needs*……

(Ezio Manzini 2000)

design for **sufficiency** (自足設計)



create a better world with ***less consumption***!



e.g.

Laundry redesign – sustainable PSS

1. own ***2. share*** ***3. share happily***

well-being

instead of

well-having !

System Design for Sustainability

‘satisfaction’

↑

function

↑

‘solution’

↑

sustainable PSS

2

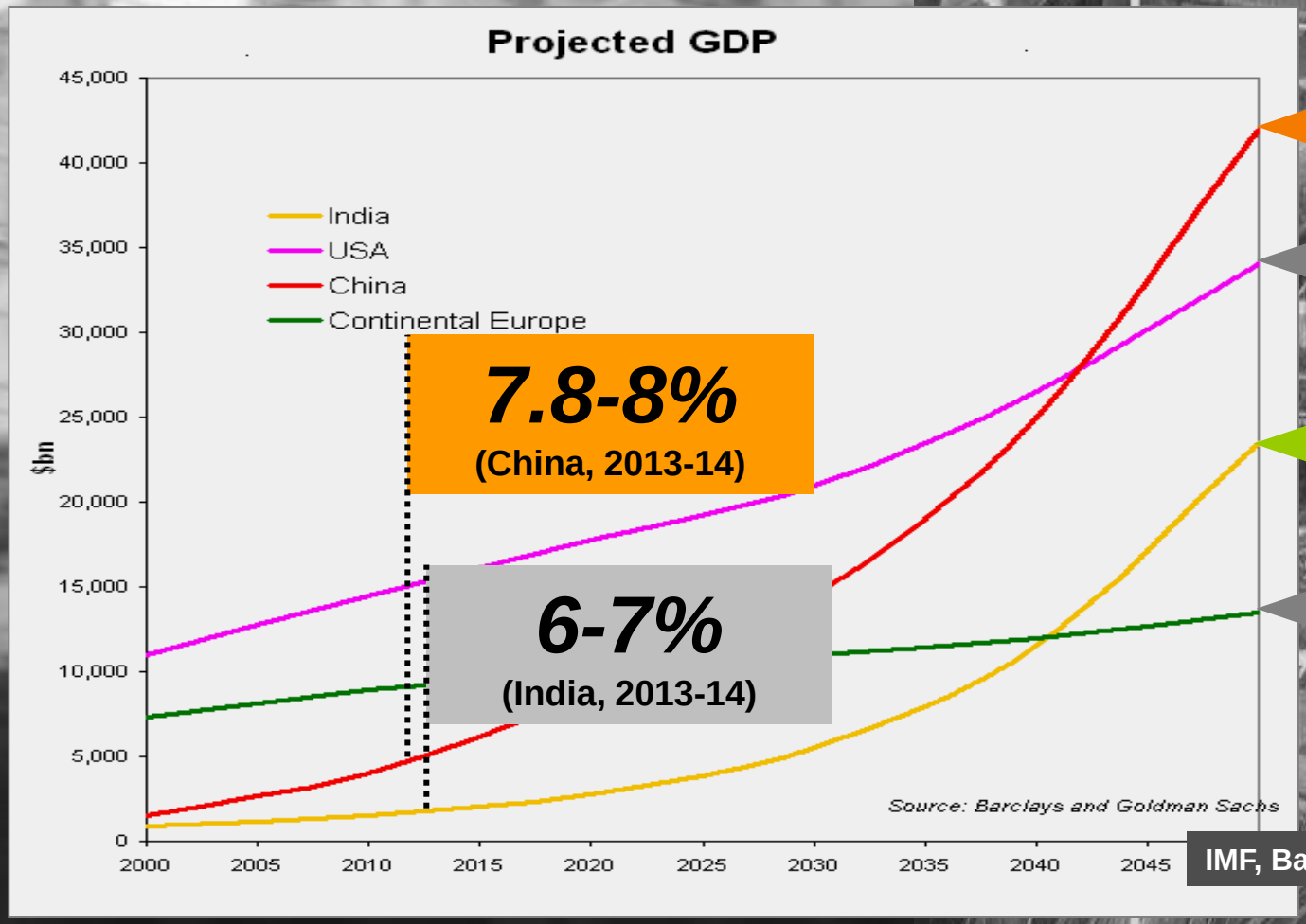
該從哪裡開始?

where should we begin?

from China……

(or emerging economies)

China + India will still *in a rapid urbanizaion period* within the decade to come! *(ET Net, 2010)*



CHINA

USA

INDIA

EU

IMF, Barclays, Goldman Sachs, RTT

http://goldsea.com/Text/index.php?id=14408

Where the **growth** will be……

	USA	Germany	HK	China	India
2002	**19.4**	**10.1**	**5.5**	**2.9**	**1.1**
2007	**18.9**	**9.6**	**5.8**	**4.9**	**1.4**
2009	**17.2**	**8.9**	**5.5**	**5.8**	**1.6**

metric tons of CO_2 per person per year

http://mdgs.un.org/unsd/mdg/SeriesDetail.aspx?srid=751

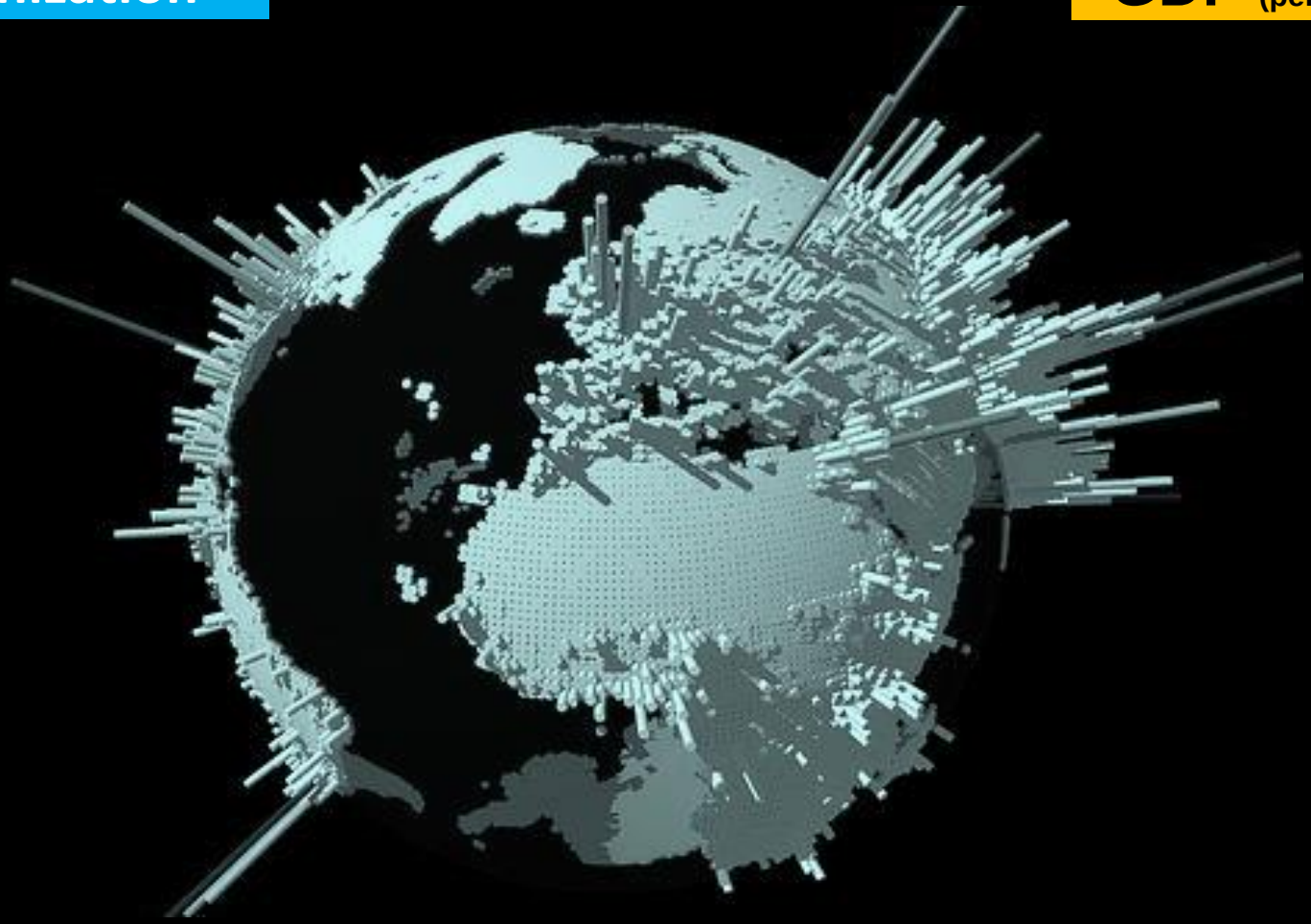
http://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions_per_capita

http://data.worldbank.org/indicator/EN.ATM.CO2E.PC

1% → 2.71%

urbanization

GDP (per capita)



(the world bank, 2007.)

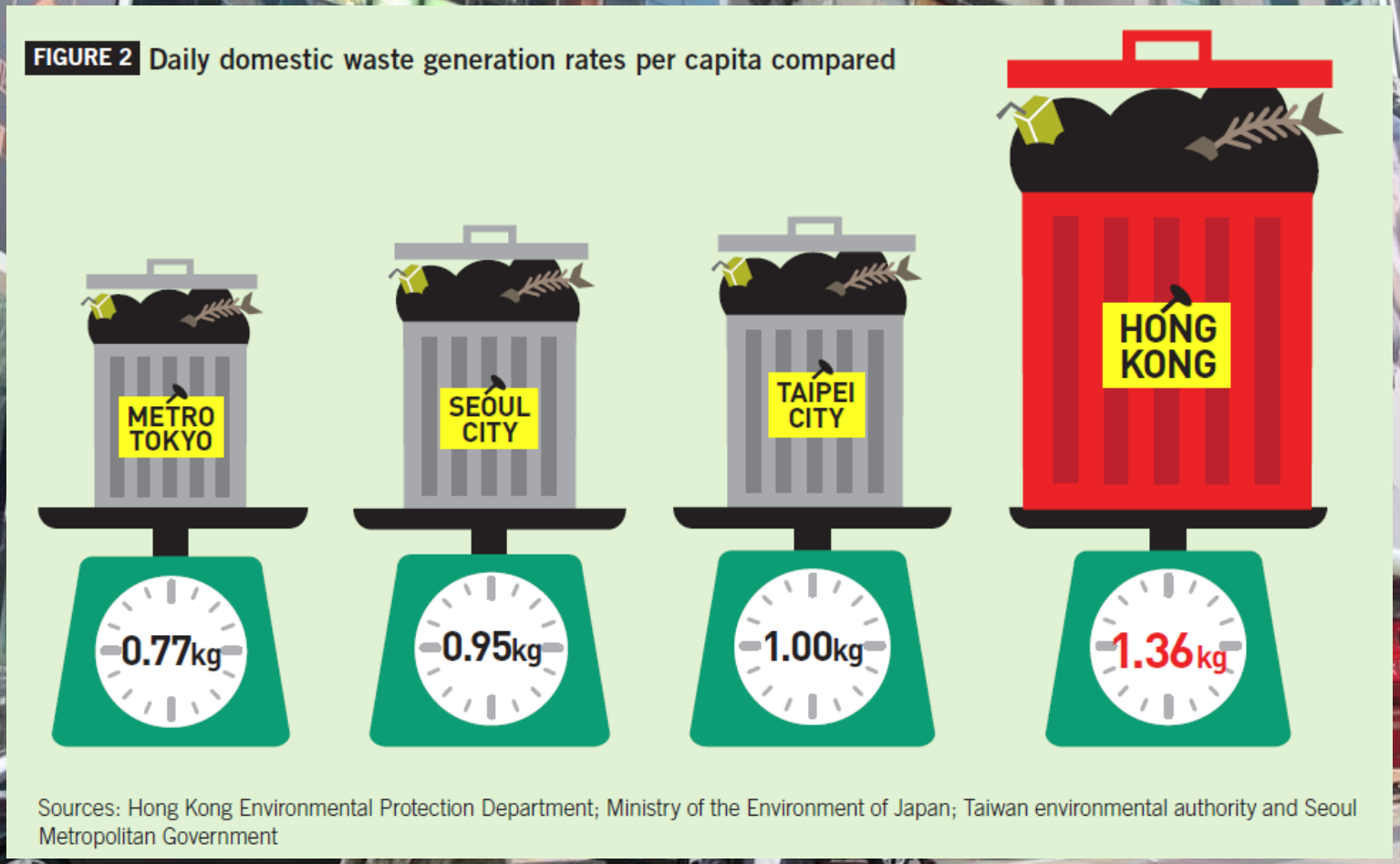
while every *1% of GDP* growth will *engender 0.9% C02 emission + related resource consumption*. ***(Bowen, et al, 2009)***

from Cities……

(like Hong Kong)

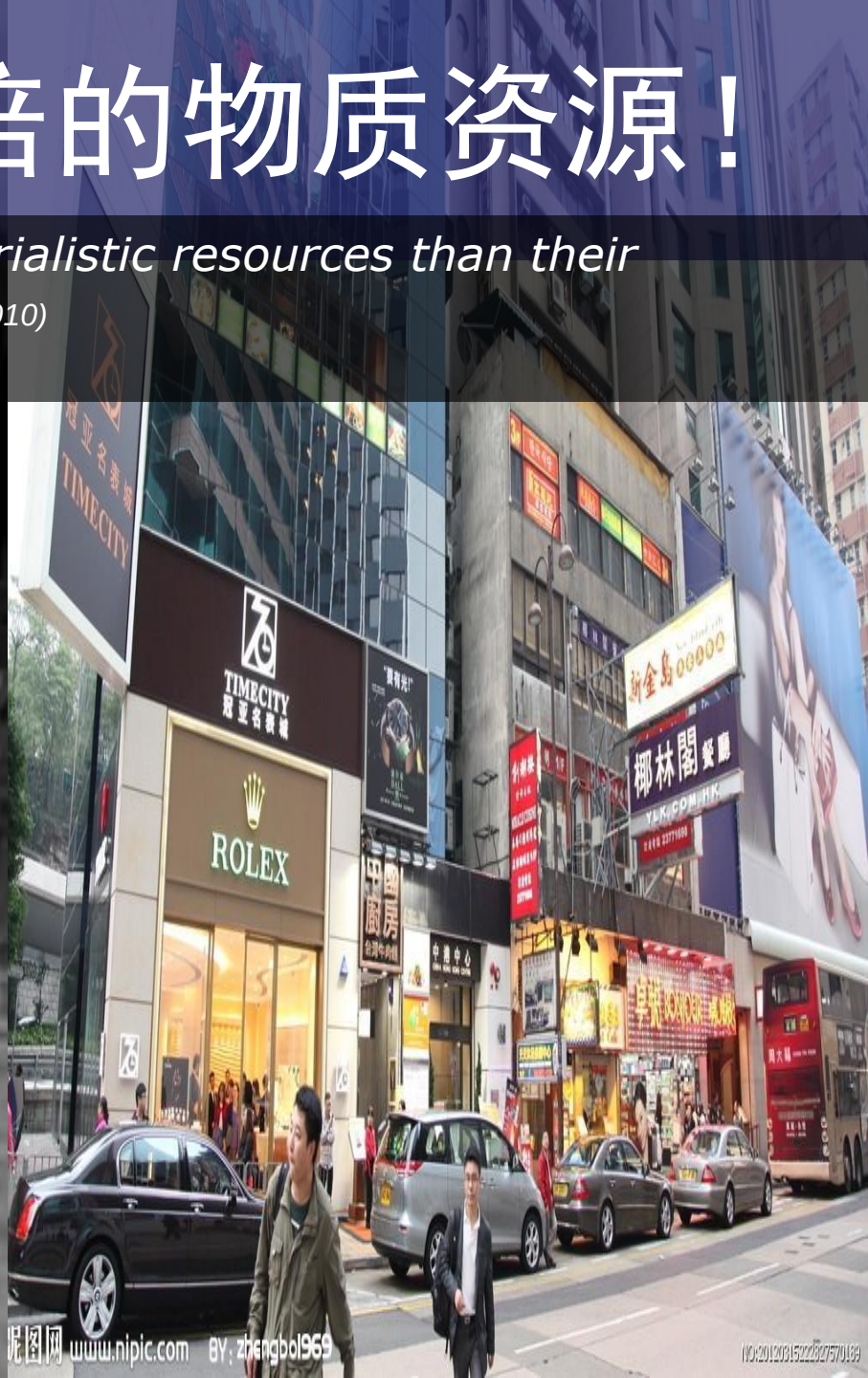
城市:高度物质化!

city is highly materialistic!



比农村消耗多4倍的物质资源！

urban city consume 400% more materialistic resources than their rural counter part..... *(Court & Narasimhan, 2010)*



from lifestyle.....

for a new
sharing economy!

P2P – sharing economy

Car Sharing

The evolution of mobility business from 2004-2011

(Anton Breman, 2011)

Lifestyle of ‘singles’ consume more !

单身文化产生更多消耗!

	family 家庭户	singles 单身户
生活垃圾 *Trash:*	*3 members*	*one* +600kg
燃料 *Fuels:*	*5 members*	*five* +60%
电 *Electricity:*		+55%
日用品 *Daily necessities:*		+39%

Germany‘s environmental protection department 德国的环保部门

from
YOU and **ME**.....

1 less for more?

commuting

stop being silly!

TaxiShare

share taxi with girly!

2 'green' and well?

resting

keep resting early!

be healthy & wealthy!

3 fun but sustainable?

shopping

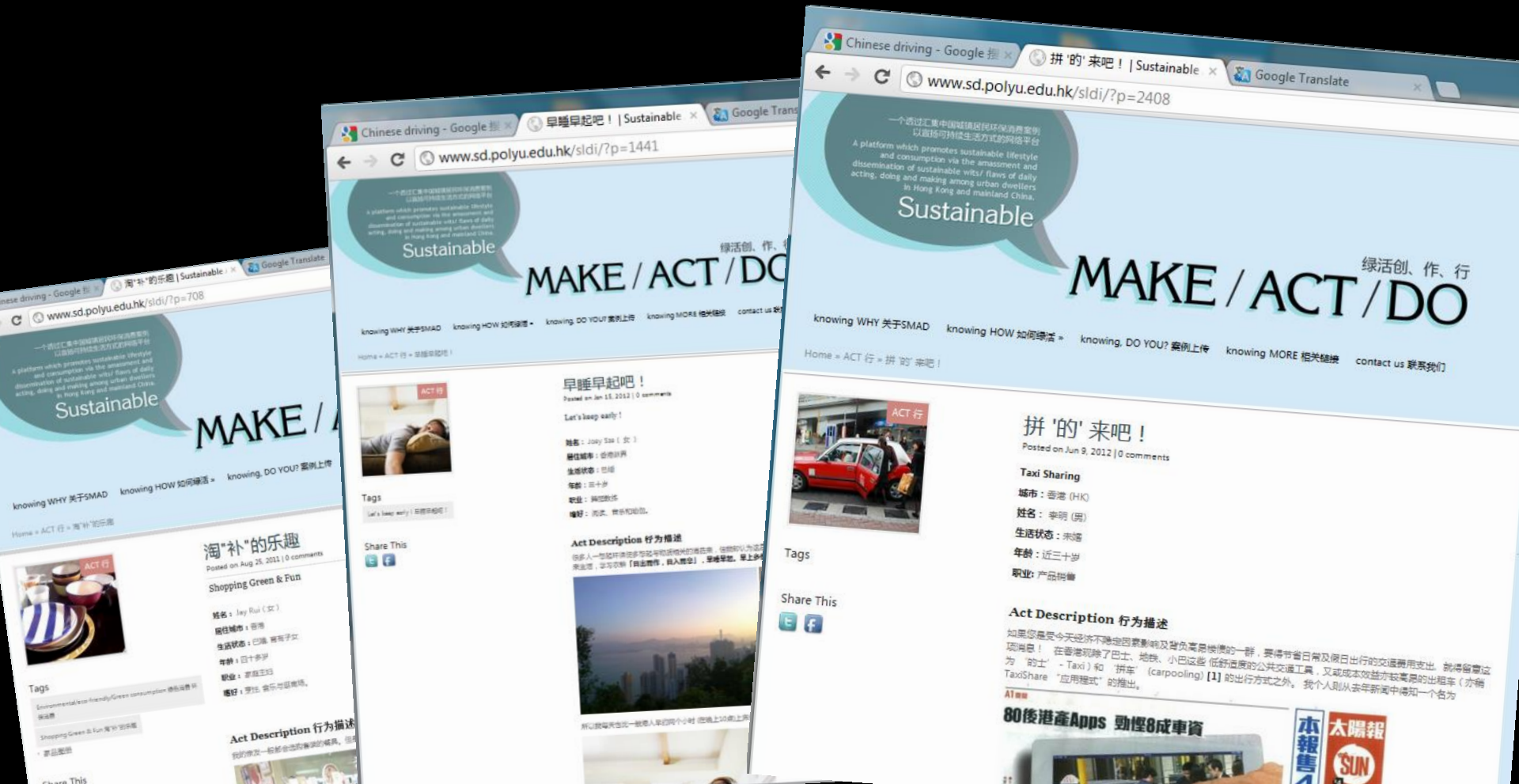
forgo buying ‘SET’….

go for mix & match !

ideas from an online platform

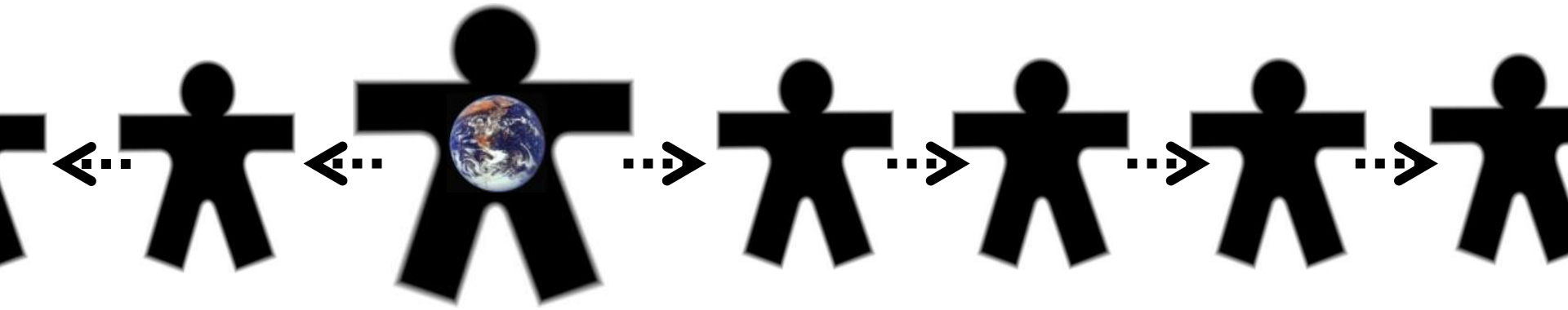
Sustainable MAKE, ACT, DO

www.sd.polyu.edu.hk/sldi/



one can influence others.....

Nicholas A. Christakis, Harvard Business Review, Feb 2009



negative: e.g. smoking →
1 degree separation= 61%, (2)29%, (3)11%

positive: e.g. happy→
1 degree separation=15%, (2)10%, (3)6%


Thank you!
謝謝