# Accelerating Low Carbon Transformation through Equitable Access to Sustainable Development

PAN Jiahua (jiahuapan@163.com)
Institute for Urban & Environmental Studies,
Chinese Academy of Social Sciences
Dec. 1, 2012

# content

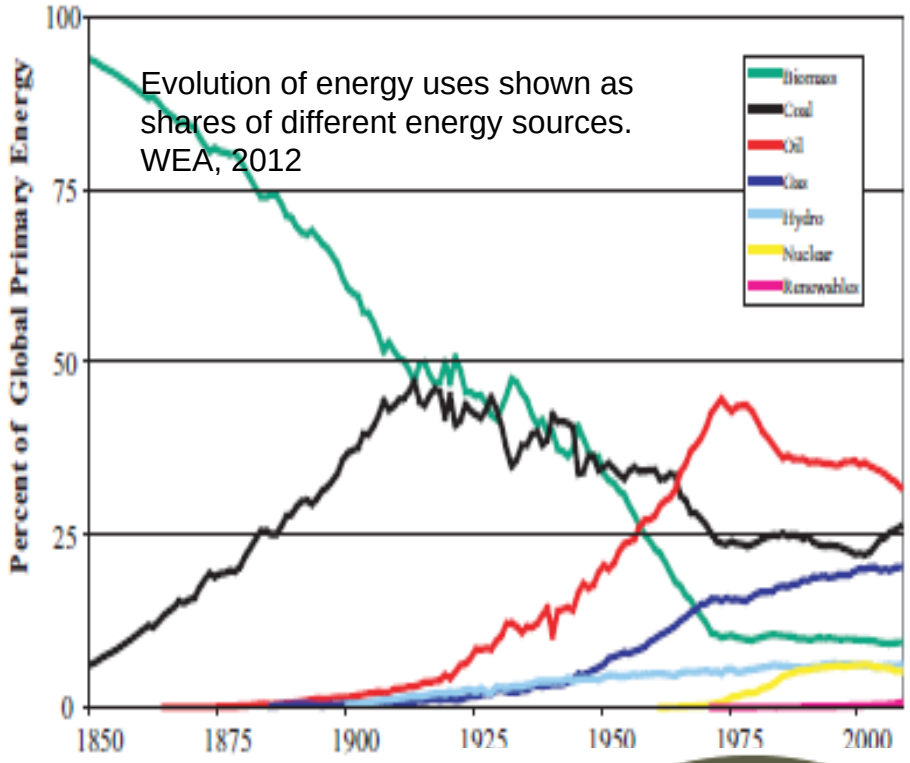
- Introduction
- Nexus security for sustainability
- Multiple wins for Acceleration of the transformation
- Removal of barrier to Equitable access to sustainable development
- Conclusions

# Introduction

- Nexus security for sustainability
  - Securities for water, biodiversity, energy, food, climate are all connected. Insecurity of energy will lead to insecurity of food, etc.
  - Applicable to all the countries, no matter developed, developing, or rapidly industrializing countries. In particular, the poor countries are the most vulnerable
- Co benefits and tradeoffs: result in multiple win solutions
  - Interconnections of sustainability factors would mean co-benefits or tradeoffs between low carbon and/or among these factors
  - Such co benefits or tradeoffs have spillover effects between or among countries/regions
- Removal of barriers to equitable access to sustainable development: carbon is only a media, what a country or individual needs is development

# Nexus security for sustainability

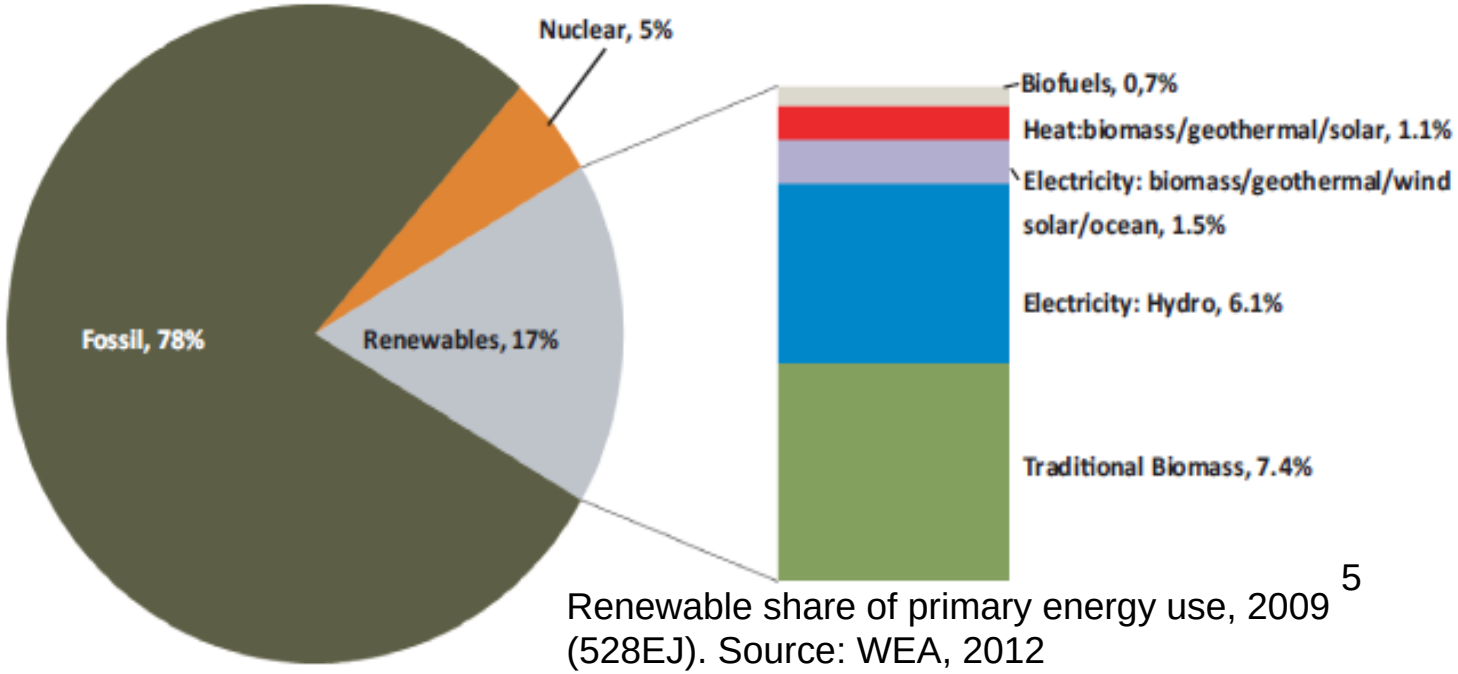
- Sustainability in perspectives: applicable to all countries, **we must have emission targets right now and for the future**
  - Geo-physically: a spaceship economy, there exists an absolute geophysical limit to human activities on planet Earth
  - Biologically: there are biological limits in terms of nutrition, life expectancy and physical build-up. But desires can be unlimited
  - Historically: zero carbon → high carbon → zero carbon
  - Philosophically: a steady state economy
  - Ethically: respect for nature, man-nature harmony




Evolution of energy uses shown as shares of different energy sources. WEA, 2012

- There are national circumstances, but in general
  - Energy use in transition from a historical perspective: renewables to fossil fuels to renewables
  - Energy security requires acceleration 0 carbon transformation: availability, accessibility, affordability

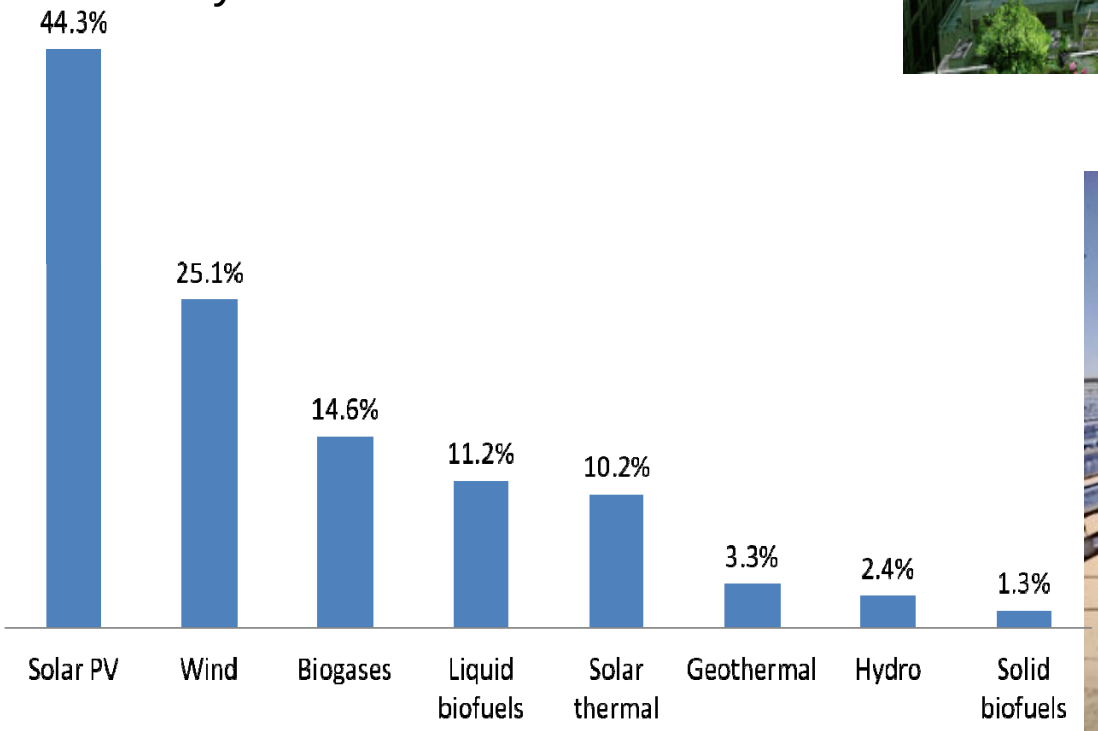
Nexus security for sustain ability




Renewable share of primary energy use, 2009 (528EJ). Source: WEA, 2012

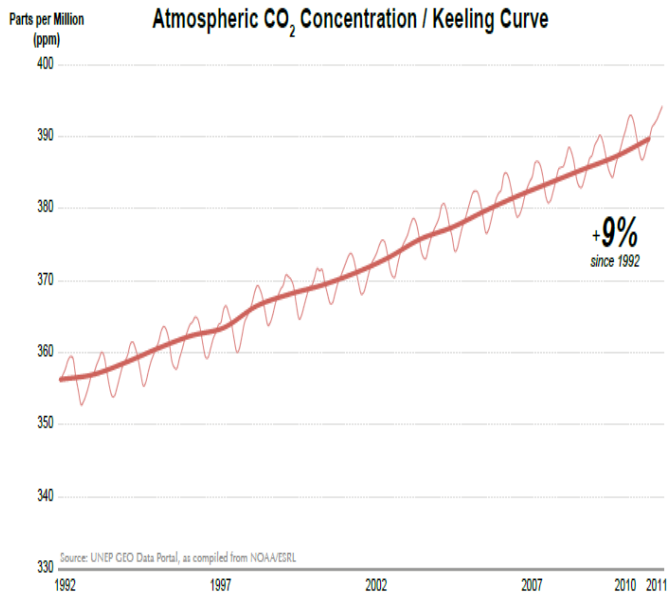
# Nexus security for sustainability

- Food security vs renewables: geophysical and biological limits
  - Energy cropping
  - Solar
  - Wind
  - hydro


Source: International Energy Agency (IEA), 2012. *Renewables Information.* Paris: OECD/IEA

# Nexus Security for sustainability





- Climate security:
  - Climate extreme events can happen at anytime anywhere
  - minimum human interference with natural system
- Water security and food security: human survival, basic necessities, desirables
- Urban resilience

# Nexus Security for Sustainability

- Human development: low carbon transformation promotes quality of living
  - Biodiversity: competition, exclusion, or in harmony
  - Quality of living: pollution, land degradation, energy services
  - Poverty eradication: natural, financial and skill constraints; access to energy services, employment, local economic development

# Multiple wins and tradeoffs: low to negative costs

- There are both co-benefits and tradeoffs, but climate protection is compatible with broad range of social targets.
- Mitigation costs can be low or even negative if the following elements are taken into account.
  - Co-benefits
  - Ancillary benefits
  - External benefits

# Multiple wins: production

- Transforming the production style: all the countries are doing, but there is a need to accelerate
  - Efficiency improvement: energy saving, monetary gains, avoidance of locked-in technologies
  - From linear to circular: recycling, reusing, minimum or zero generation of wastes
  - Multiple wins: energy security, financial savings, material savings,

# Multiple wins: zero carbon energy

- Promotion of Zero carbon transformation produces multiple benefits
  - Equipment manufacturing
  - Installation, operation and management
  - Multiple wins: employment, energy security, economic growth

# Multiple wins: sustainable consumption

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| A) |  |  |  |  |  |  |  |
| | 2 000 | 9 000 | 14 000 | 17 000 | 19 000 | 22 000 | 80 000 |
| B) MJ/p-km | 1.65-2.45 | 0.32-0.91* | 0.1 | 0.24* | 0.2 | 0.53-0.65 | 0.15-0.35 |
| C) €/p-km infrastructure | 2 500-5 000 | 200-500 | 50-150 | 600-500 | 50-150 | 2 500-7 000 | 15 000-60 000 |
| D) Fuel | Fossil | Fossil | Food | Fossil | Food | Electricity | Electricity |

World Energy Assessment Report, 2012.

- Transport: from SUVs to public transport, bicycle, walking
- Natural ventilation, minimum use of air conditioning and heating
- Nutrition: more vegetables less animal fats
- Multiple gains: resource saving, financial saving, healthier, happier

# Institutions: multiple wins

- Institutions are of great significance for low carbon transformation and EASD
  - Spatial and Urban planning,
  - Legislation and regulation
  - Standards
  - Policies
- Low carbon institutions lead to Multiple wins: nexus security, resource saving, financial saving, public aspiration

# Barrier removal to EASD

- Understanding historical responsibility
  - Environmentally:
    - Pros: Historical emissions are responsible for current change of climate,
    - Cons: Diminishing in the atmosphere
  - Economically:
    - Pros: accumulation of carbon in stock in the process of industrialization and urbanization
    - Cons: carbon efficiency varies a great deal: productivity of one ton of carbon today is several or hundreds times that a hundred years earlier

# Barrier removal to EASD

- Understanding historical responsibility
  - Legally:
    - Pros: attribution of current harms to historical responsibilities, or ethically
    - Cons: unaware of the harms of emissions, no legal responsibility
- A solution: discounting the amount of emissions and responsibilities using Automatic Energy Efficiency Index (AEEI)

# Barrier removal to EASD

- The nature of carbon emissions
  - Public goods: capacity based principles – the richer pays more
    - Pros: fair. the rich has the ability to pay
    - Cons: unfair if the rich do not emit at all
  - Consumption goods: market based principles – efficiency counts
    - Pros: fair. efficient allocation of limited carbon space through market for maximum returns
    - Cons: unfair. not  a consumable, embedded in fossil fuel for cheap energy service.  The poor will be excluded to affordable energy services

# Barrier removal to EASD

- The nature of carbon emissions
  - Externality: responsibility based principles – polluter-pays. Attribution of responsibilities to emitters
    - Pros: fair. Polluter pays. Internalization of externalities for correction of market failure
    - Cons: unfair. Carbon is linked to welfare function with respect to development. There fore, everybody must have a fair share of the emission space or emission rights. In addition, the polluter may dictate a low pay or no pay for externality. Further more, external costs cannot be easily measurable.
- A conclusion: emission issue cannot be resolved under the domain of public goods, consumption goods, and externalities.

# Barrier removal to EASD

- The nature of carbon emissions
  - Entitlements to
    - Current emissions: equitable access to emission space – equal per capita emissions at a given point in time
    - Historically accumulative emissions: equitable access to accumulative emissions for a given period of time
    - Sustainable development: physically adjusted historically accumulative emissions, which are exchangeable/tradable in financial and technological market
  - A solution
    - what we need is energy service for development, not carbon.
    - So long there is energy service, no matter zero carbon or carbon intensive, its contribution to development can be measured the same.
    - As carbon space is limited and development is a lengthy process, carbon can be made tradable discounted against time

- **Developing countries pledges amount more than developed countries**

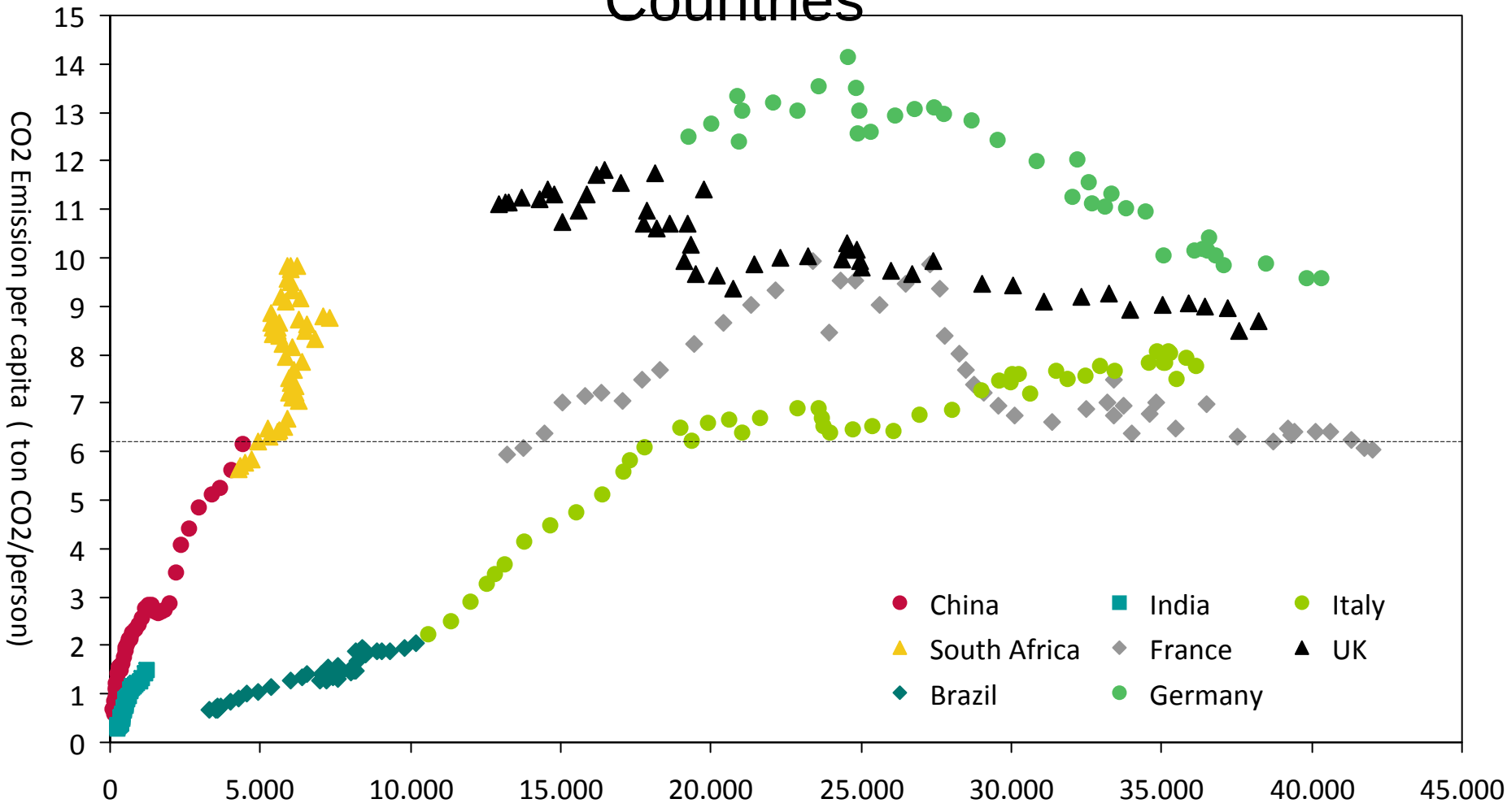
  **but major increases of emissions are mainly from the developing world, as they are still in the process of urbanization and industrialization and**

  **there is a lack of confidence in fast move to zero carbon world in these countries**

| | Intensity target (Jotzo 2010) | Mitigation to BAU level (Jotzo 2010) | Share of global pledged mitigation | | | |
|---|---|---|---|---|---|---|
| | | | UNEP 2011 | Climate Action Tracker(2011) | McKinsey & SEI (2010) | Jotzo (2010) |
| Annex 1 | -37% | -23% | 30.1% | 25% | 42.7% | 36.5% |
| Non-Annex 1 | -45% | -24% | 69.9% | 75% | 57.3% | 63.5% |

Source: re-calculated according to pledges of mid-point target range, from UNEP(2011), Climate Action Tracker(2011), Mckinsey & SEI (2011), Jotzo (2010).

# Emissions trends: GDP per capita and $CO_2$ Emission per capita, BASIC and Major EU Countries




Data Source：

1.CO2 Emission data is from Carbon Dioxide Information Analysis Center(CDIAC) and Oak Ridge National Laboratory 2011，include emission from fossil fuel combustion and Cement process 。

2.GDP Data is from World Bank Database 2012， Price is 2010 dollar constant price。

3.Data of CO2 Emission from fossil fuel combustion from CDIAC and IEA are basically Consistent， Error is in 1%.

# EASD: a budget approach to sustainability with equity and efficiency

- ***Setting the global carbon budget*** that includes **historic** and **future** budget compatible with the temperature control target;

- ***Allocating the global budget*** among all countries according to **per capita accumulative principle**; and establish ***Budget Accounts*** for each country or groups.

- ***E*stablishing an effective international collaborative mechanism** based on the initial allocation. Countries with emission deficit or insufficient budget can balance their budget from the countries with surplus through trading, tech transfer, or other collaborations.

- ***Nexus security/co benefits*** calculations further prioritize EASD actions.

# EASD: a budget approach
# How much is a country's balance?

Depends on:

*(1)How much its emissions entitlements is.*

*(2)How much it has emitted.*

*(3)How much it gets from intl. collaborations through purchase, technology transfer & funds contribution(+ or -)*

- Balance = entitlements –actual emissions + intl. collaborations

# EASD: a budget approach

- Sustainability is ensured: the **global target** on emission reduction can be guaranteed.
- Equitable access to **carbon not in physical terms but in carbon productivity terms ----**the principle of ‘common but differentiated responsibilities’ is properly reflected and becomes operational (entitlements but historical emissions discounted).
- Efficiency: emissions trading
- **Climate debts and climate finance: full coverage of** all countries with respect to their budget status, surplus or deficits
- Compatible with the existing efforts.

# From zero-sum game of ***burden-sharing*** to win-win situation of ***opportunity-grabbing***

- Nexus security / co benefits help make the shift for accelerating the low carbon transformation process
  - Low carbon development is the ultimate solution to global climate change, and emission mitigation also means **great opportunity**.
  - A more constructive and positive position is logic for all countries----There is no future for solving global climate change if fail to recognize the opportunity but just take emission mitigation as a burden.
  - Developed countries need to take the lead and demonstrate the feasibility of LCD, and help the developing countries in the transformation process

# Budget available can be made compatible with necessity needs and trading for higher level of emissions per capita

**Total budgets of carbon emissions available for meeting 2 degree target at 50% probability, excluding LULUCF**

| | Starting Year | Historical emissions (*~1999, GtCO2) | Future emissions (2000~2050, GtCO2) | Total carbon budget (*~2050, GtCO2) | Cumulative per capita emission (*~2050, tCO2) | Cumulative annual per capita Emission (*~2050, tCO2) |
|---|---|---|---|---|---|---|
| **1** | **1850** | **965.26** | **1440** | **2405.26** | **396.65** | **1.97** |
| **2** | **1900** | **927.10** | **1440** | **2367.10** | **390.36** | **2.59** |
| **3** | **1970** | **574.04** | **1440** | **2014.15** | **332.13** | **4.10** |

**Make the carbon budget (GtCO2) a resource for EASD**

| | Total budget (1900-2050) | Entitled Budget 1 (1900-1999) | Entitled Budget 2 (2000-2050) | Historical cumulative emission (1900-1999) | Historical surplus/deficit (1900-1999) |
|---|---|---|---|---|---|
| **World** | **2367.10** | **1567.62** | **799.48** | **930.91** | **636.71** |
| **Annex 1** | **483.25** | **320.03** | **163.22** | **721.91** | **-401.88** |
| **Non-Annex 1** | **1883.85** | **1247.58** | **636.27** | **209.00** | **1038.58** |

**Source: Pan Jiahua Chen Ying, 2011)**

## Financial liability calculated for historical responsibility With and without AEEI depreciation (AEEI at 1.5%/a, billion $)

| Annex I | Historical deficit (GtCO2) | Financial liability at 20t$/tCO2 | Financial liability at 50$/tCO2 | Financial transfer per year at 20$/tCO2 (2011~2050) | Financial transfer per year 50$/tCO2 (2011~2050) |
|---|---|---|---|---|---|
| **Without depreciation** | **401.9** | **8,039** | **20,098** | **200.94** | **502.35** |
| **Emissions depreciated** | **143.8** | **2,876** | **7,190** | **71.90** | **170.74** |
| **Price deprecated** | **417.3** | **6,178** | **15,444** | **154.44** | **386.1** |

**Assuming AEEI at a rate of 1.5%/a, $50／tCO2 today, 20year back, only $ 37，50 year back $ 24，100 year back $11／t.**

CASS Team calculation, 2011

# Conclusions: the way forward

- Climate compatible development for climate security: nexus security / co benefits
- Transforming the energy system for securer energy supply with zero carbon: affordable, sustainable, and reliable
- Consumption ethics: sustainable and low carbon, respect for nature, away from wasteful and luxurious consumption
- Integration: pollution control, low carbon, ecological restoration
- Working together under EASD framework: global efforts



**Zero carbon revolution**: an opportunity for multiple benefits such as energy security, jobs, income, better environmental quality