

# Transformative Pathways towards Sustainability:

*can we **think** "out of the box?"*  
*can we **act** "out of the box?"*

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IIASA Director General and Chief Executive Officer

Professor Earth System Science

Wageningen, Netherlands

## Summer

summer  
temperate  
Rough winds  
summer  
hot  
fair fair  
nature summer  
fair  
shade  
time  
life

## Shall I Compare Thee To A Summer's Day?

by William Shakespeare

Shall I compare thee to a summer's day?  
Thou art more lovely and more temperate.  
Rough winds do shake the darling buds of May,  
And summer's lease hath all too short a date.  
Sometime too hot the eye of heaven shines,  
And often is his gold complexion dimm'd;  
And every fair from fair sometime declines,  
By chance or nature's changing course untrimm'd;  
But thy eternal summer shall not fade  
Nor lose possession of that fair thou ow'st;  
Nor shall Death brag thou wander'st in his shade,  
When in eternal lines to time thou grow'st:  
So long as men can breathe or eyes can see,  
So long lives this, and this gives life to thee.



# SUSTAINABLE DEVELOPMENT GOALS



➔ Japan – SDG Implementation Guiding Principles & Specific Measures to Achieve SDGs



Sources: BBC, Salon

# JAPANESE GOVERNMENT RESEARCH GOALS

“To position Japan as the world’s most innovation-friendly country”

Japan Revitalization Strategy 2016

## Abenomics

- Maximize introduction of renewable energy
- Conduct a comprehensive reform in energy for the first time in 60 years
- Support Growth in areas including the Internet of Things and Big Data
- Extend the “Energy Efficiency Benchmark Program”



# Integrated Systems approach to SDG-Pathways

We lack a truly integrated, comprehensive quantitative understanding of sustainable development pathways, accounting for the inter-linkages between the economy, technology, environment, climate, human development and planetary boundaries.

# Food for a Week, Aboubakar Family

© 2005 PETER MENZEL PHOTOGRAPHY



**TCHAD** 230 000 réfugiés de guerre soudanais vivent dans les camps de l'Onu. Chacun a droit à 2100 Cal par jour: céréales, sucre, sel, huile, légumes secs et farine vitaminée.

# Food for a Week, Melander Family

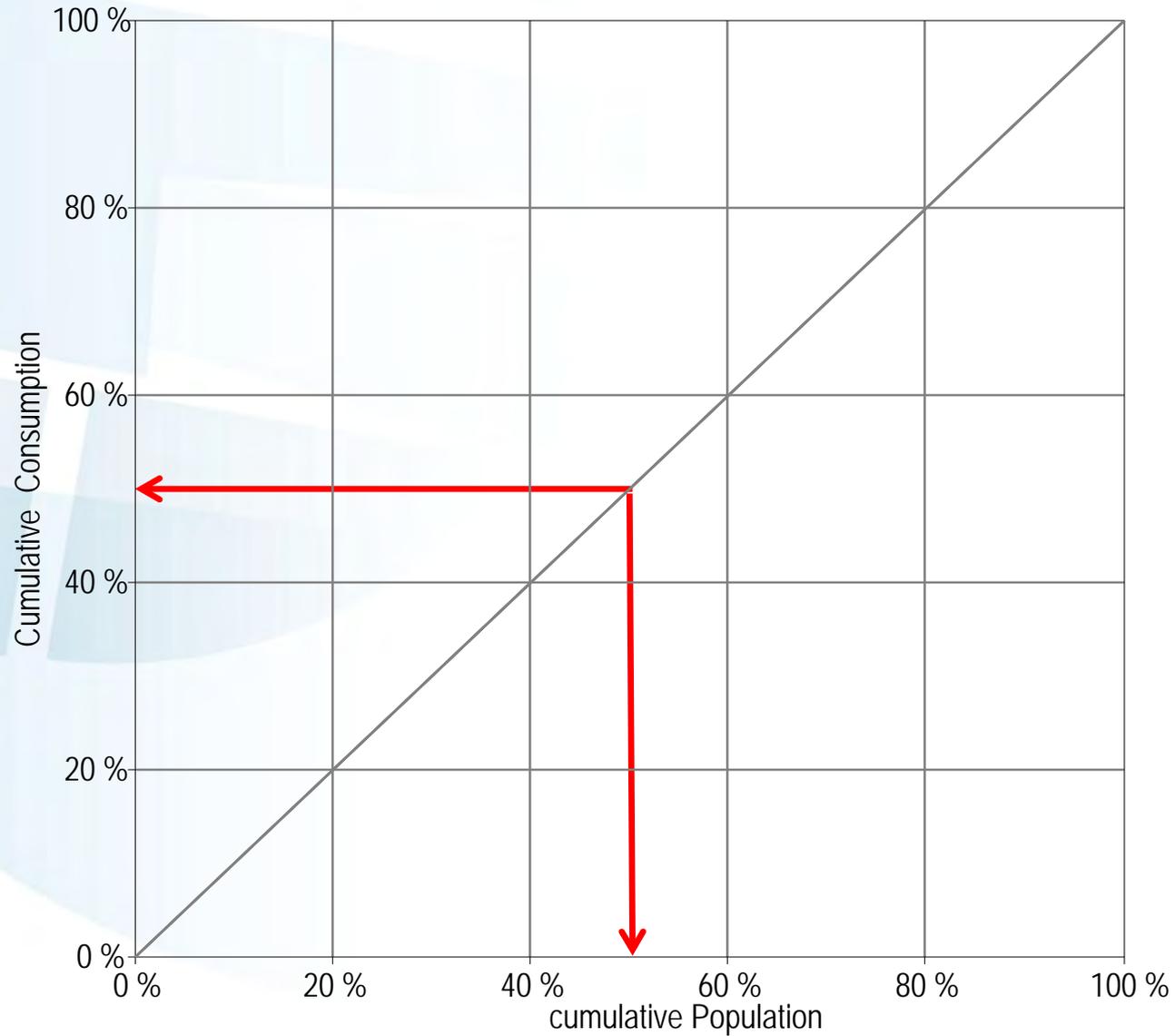
© 2005 PETER MENZEL PHOTOGRAPHY

375 C par semaine  
pour manger  
en Allemagne  
des Allemands  
gourmands.  
Leurs plats favoris ?  
Nouilles, frites,  
pizza, pudding.

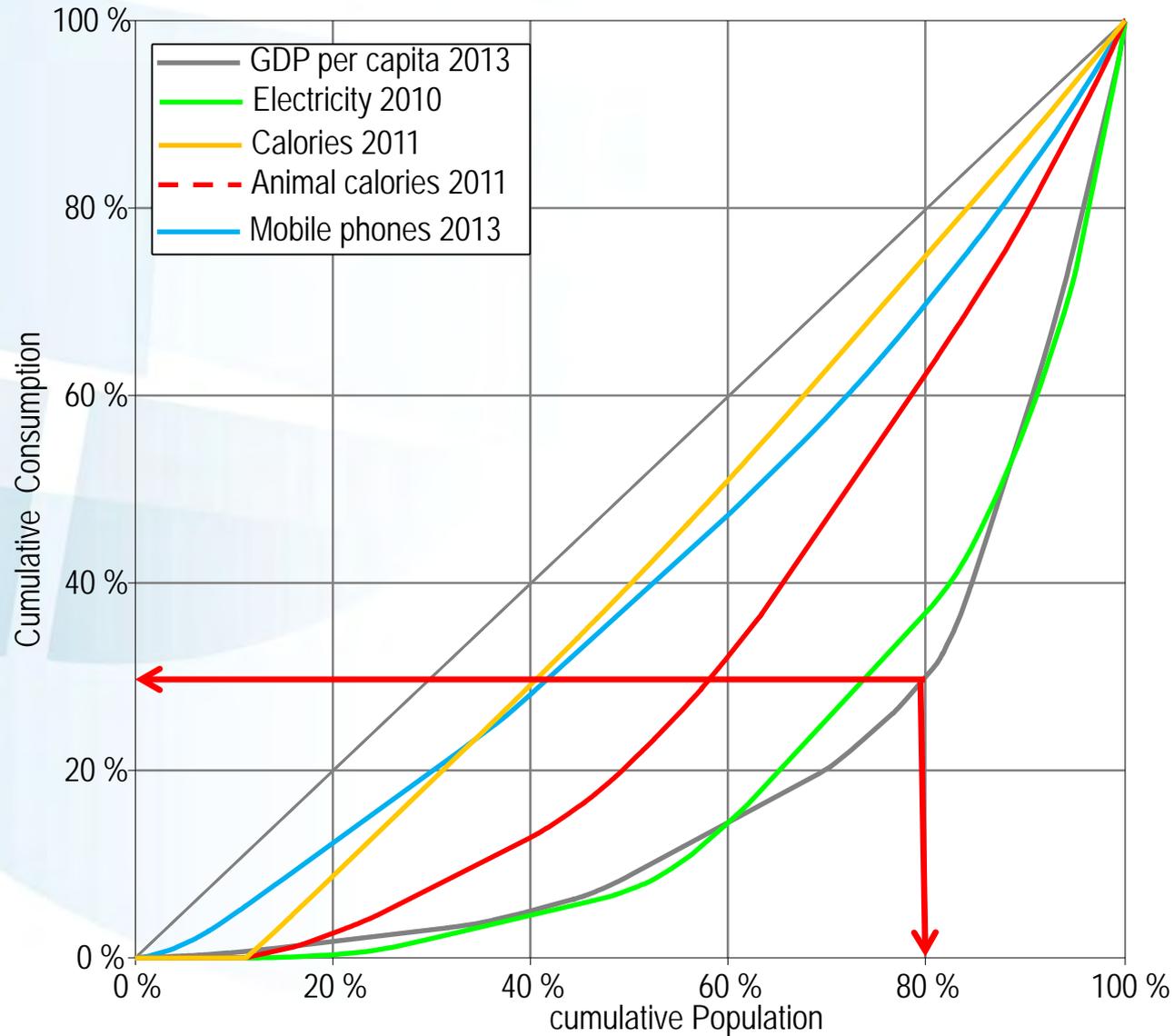


ALLEMAGNE 1500 sortes de saucisses, 1200 restaurants McDonald's, 750 millions de kebabs avalés chaque année... Plus de la moitié des Allemands sont en surpoids ou obèses.

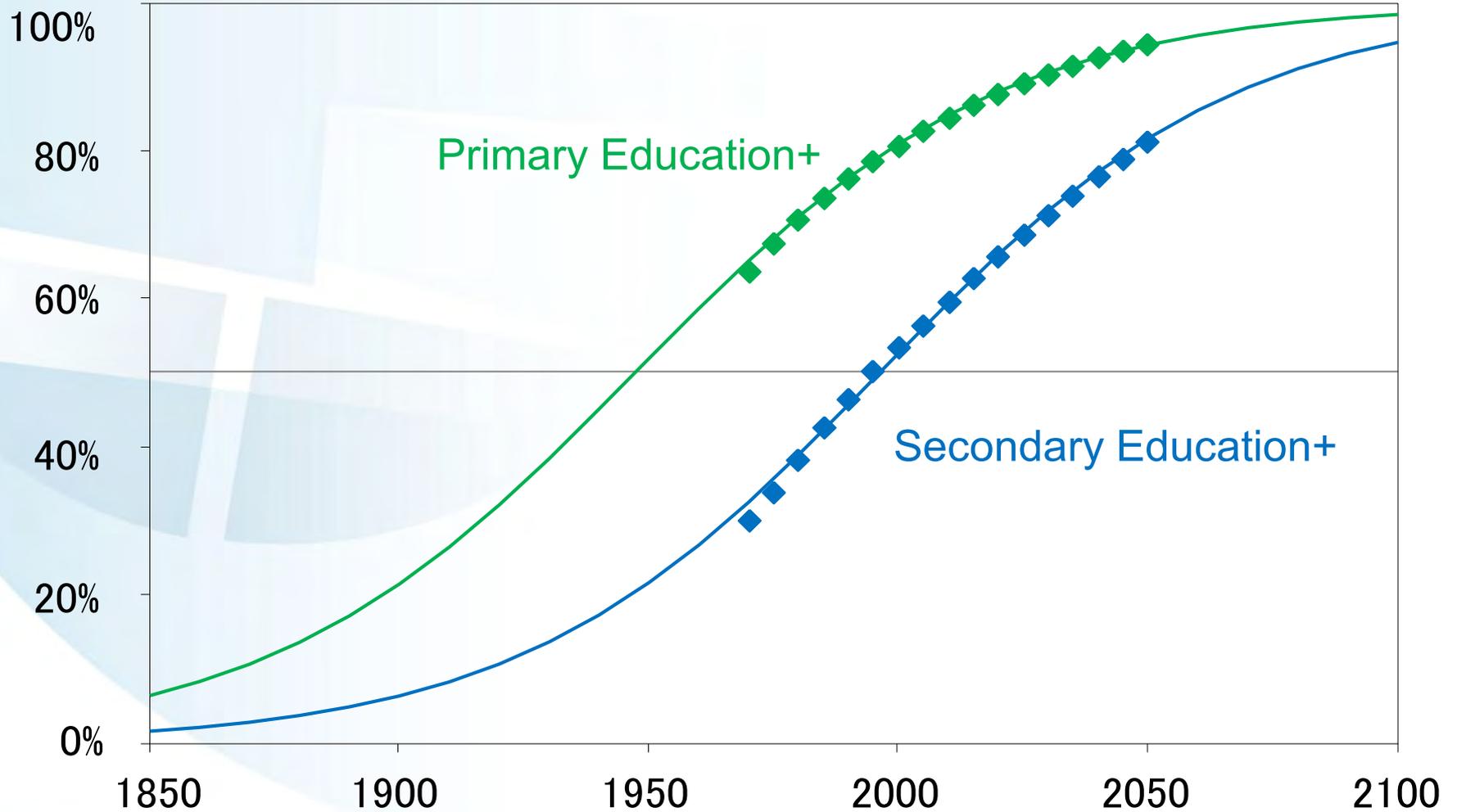
# Global Lorenz Distributions



# Global Lorenz Distributions

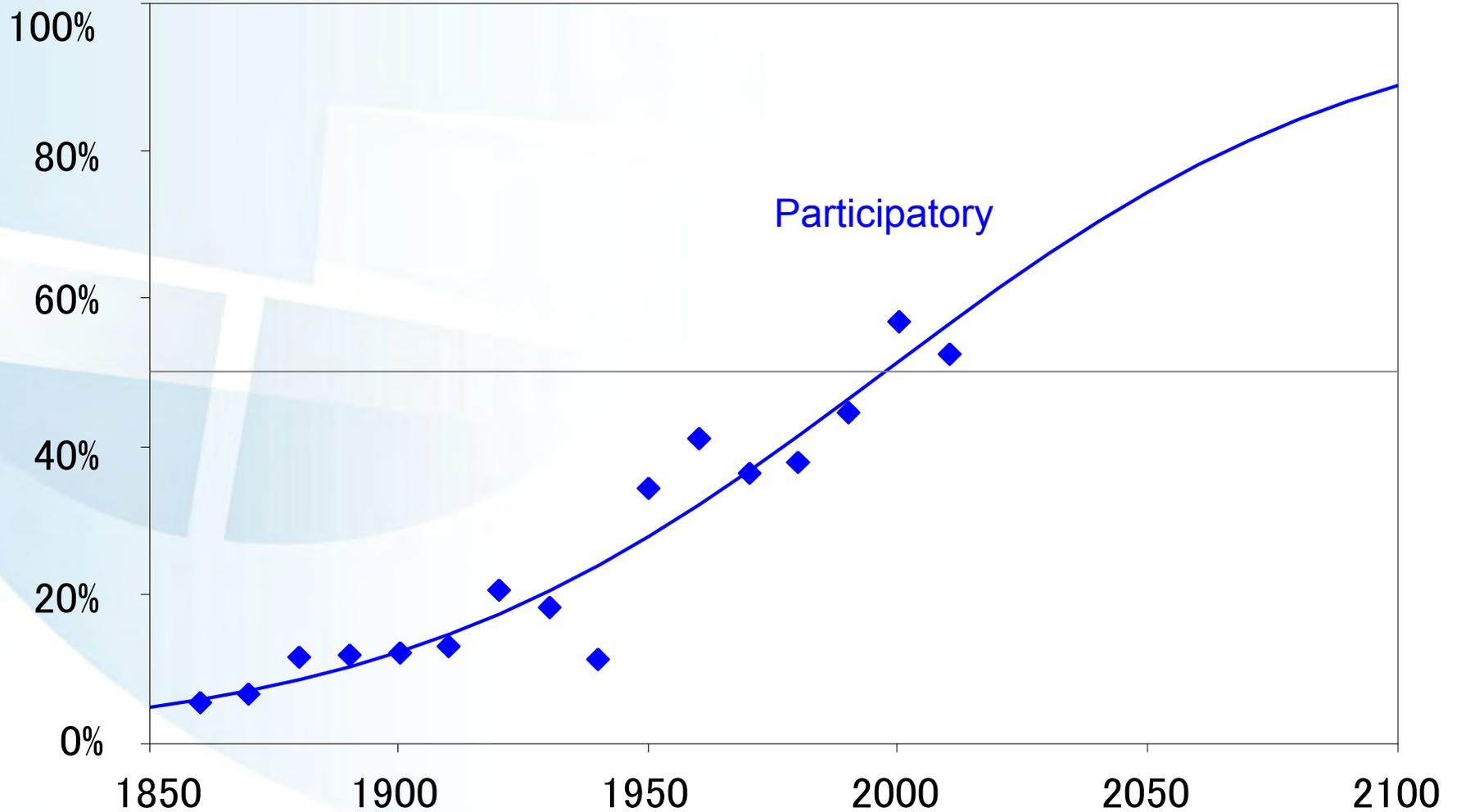


# Global Educational Attainment



Source: Lutz et al. (2007)

# Diffusion of Democracy



Source: Modelski & Perry, 2002; 2010

# Sustainable Development:

*unprecedented opportunities for accelerated innovations*

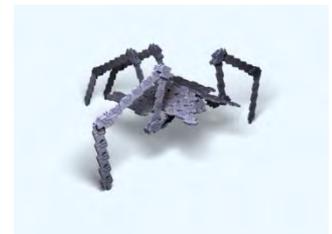
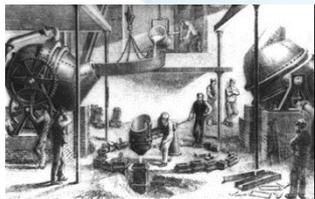
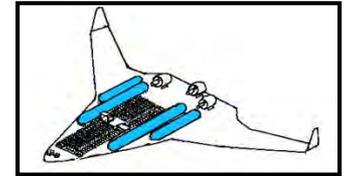
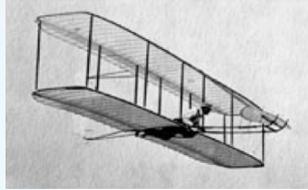
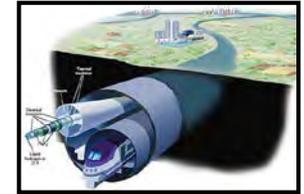
1850

1900

1950

2000

2050



Source: After Granger Morgan, 2013

# Disruptive Changes ?

## Easter Parade on Fifth Avenue, New York, 13 years apart

1900: where's the car?

1913: where's the horse?



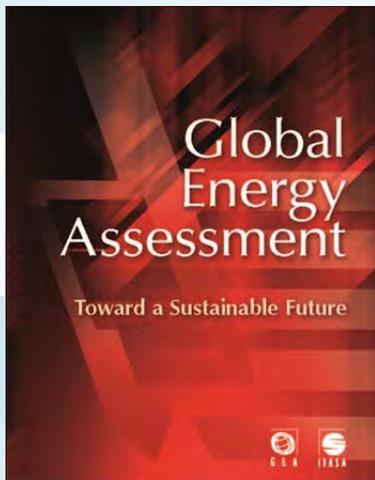
Images: L, National Archive, [www.archives.gov/research/american-cities/images/american-cities-101.jpg](http://www.archives.gov/research/american-cities/images/american-cities-101.jpg)

R, [shorpy.com/node/204](http://shorpy.com/node/204).

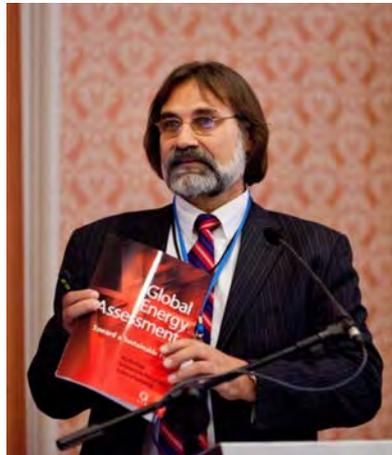
Inspiration: Tona Seba's keynote lecture at AltCar, Santa Monica CA, 28 Oct 2014,

<http://tonaseba.com/keynote-at-altcar-2014-100-electric-transportation-100-solar-by-2030/>

# GLOBAL ENERGY ASSESSMENT

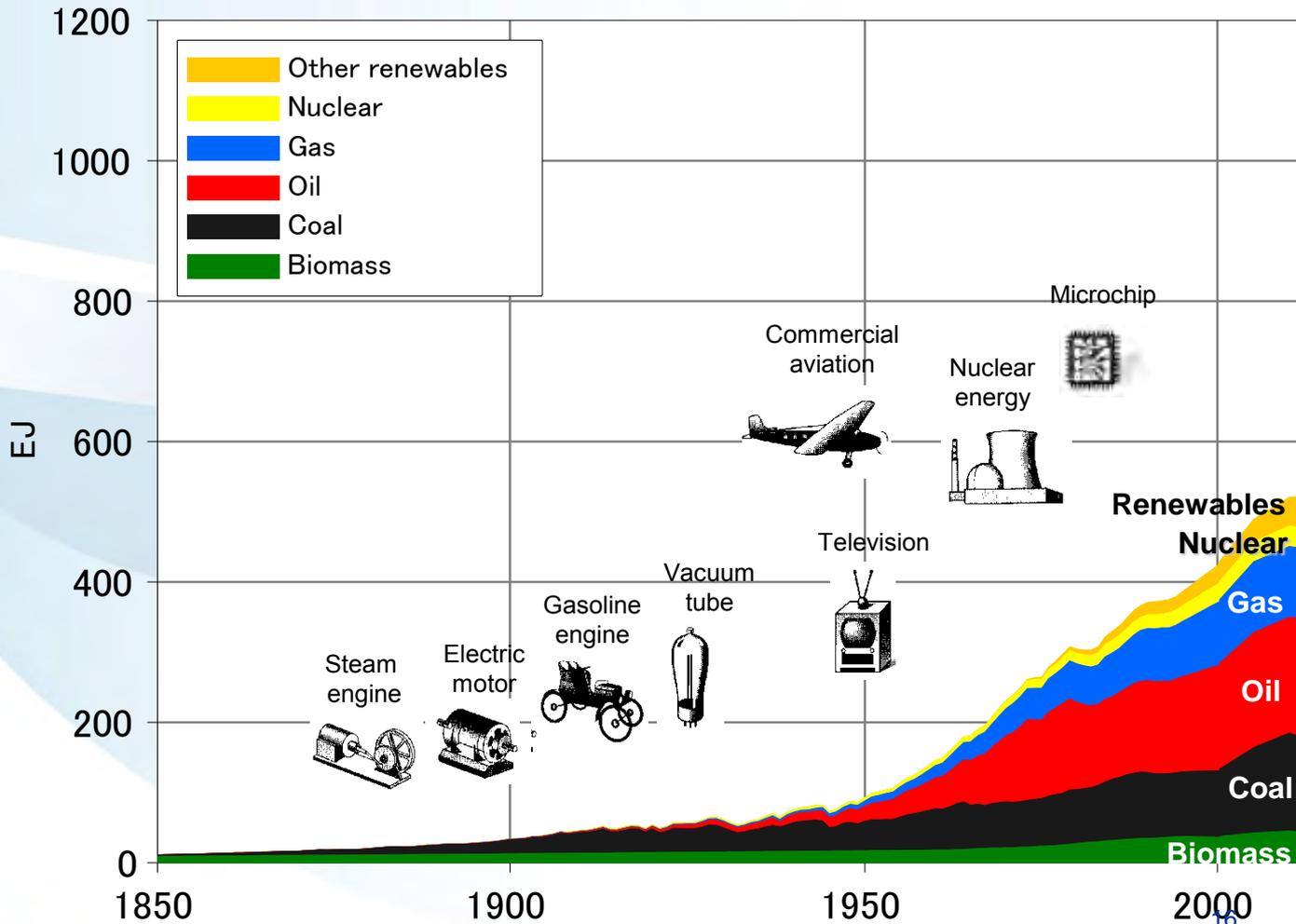


2006-12: GEA defines a new global energy policy agenda—one that transforms the way society thinks about, uses, and delivers energy.

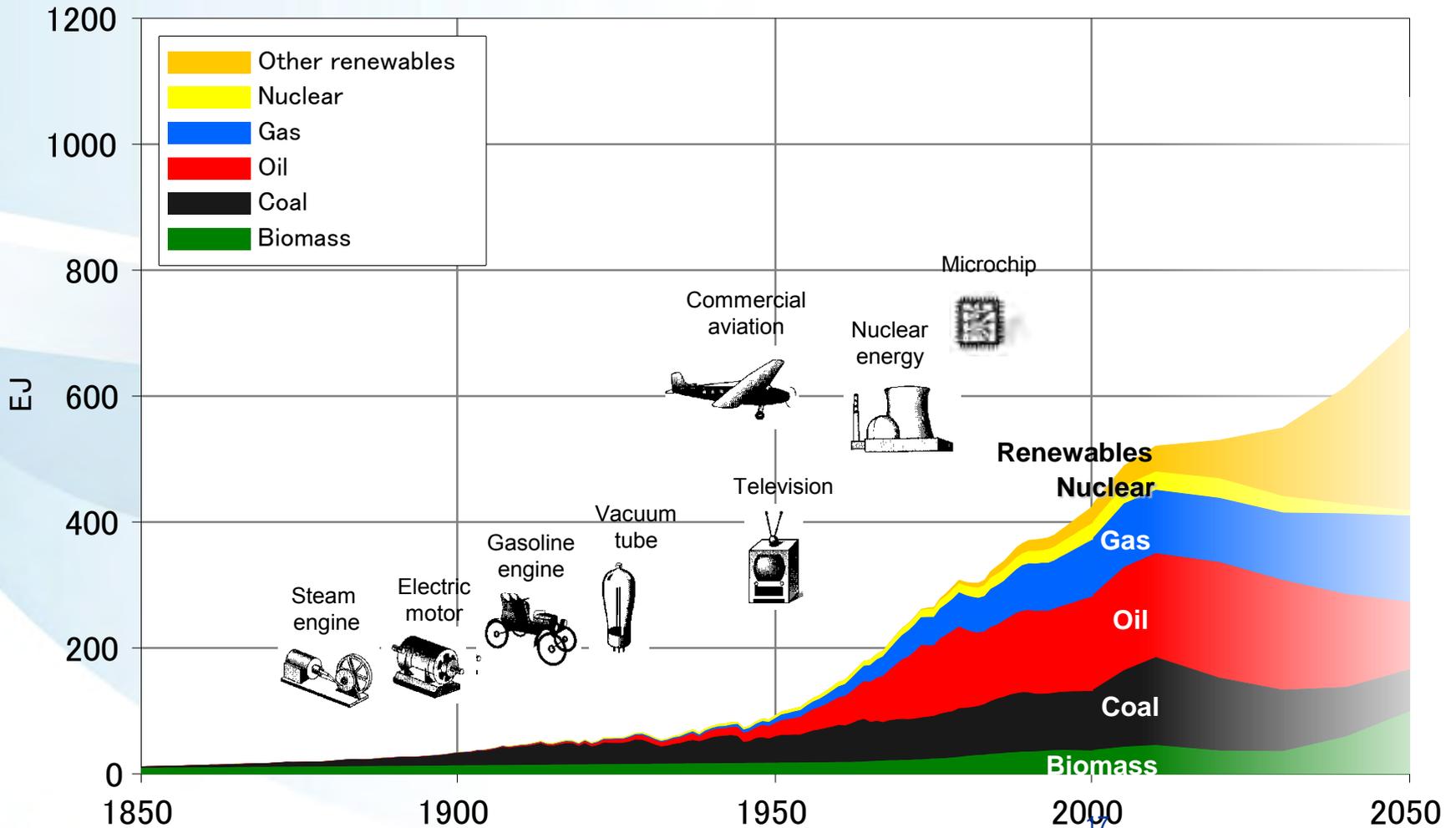


Significant Japanese contribution:  
Nine lead analysts, four contributors and one reviewer  
Findings relevant to Japan and Asia were presented at a workshop in Tokyo in 2013

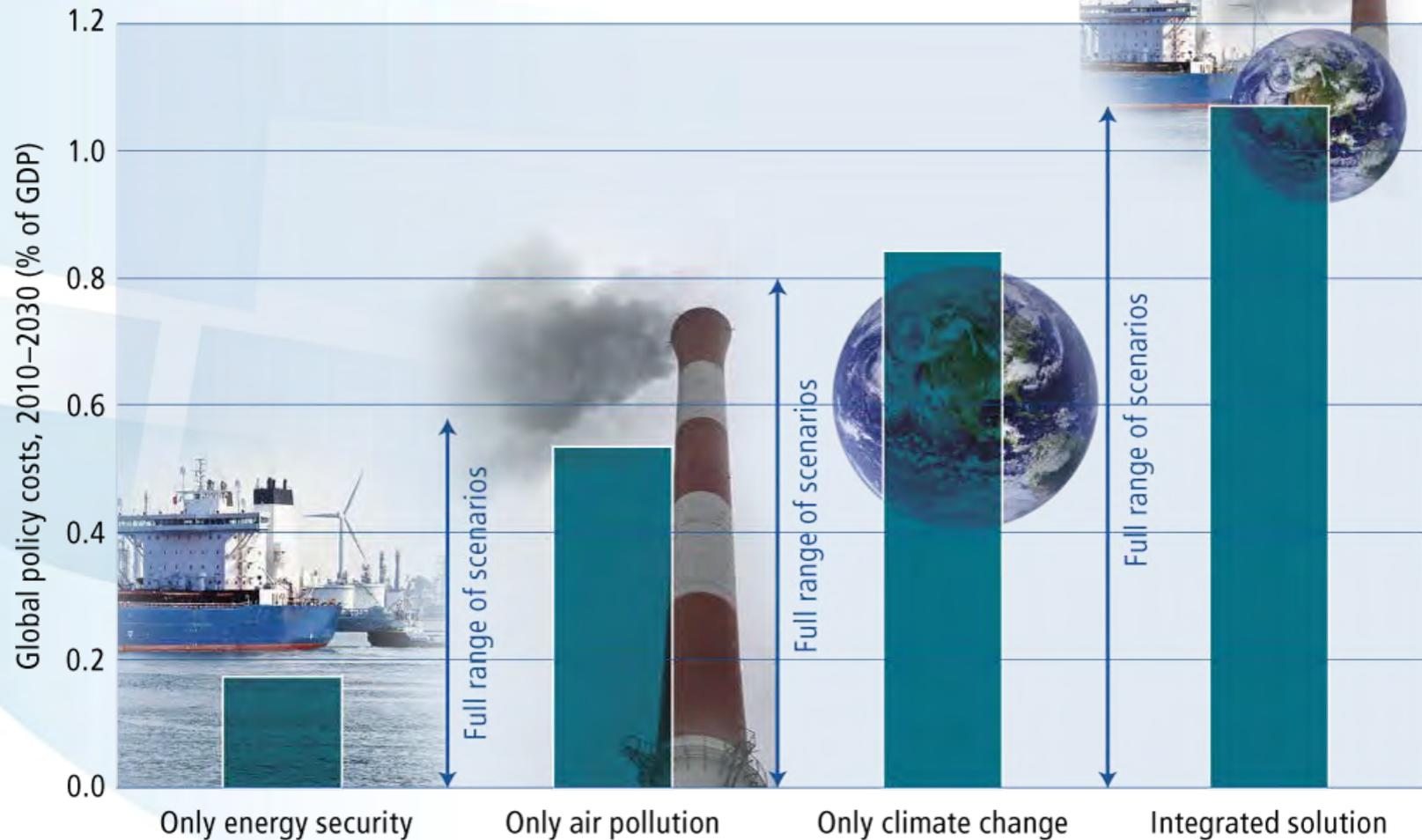
# Global Primary Energy



# Global Primary Energy Efficiency



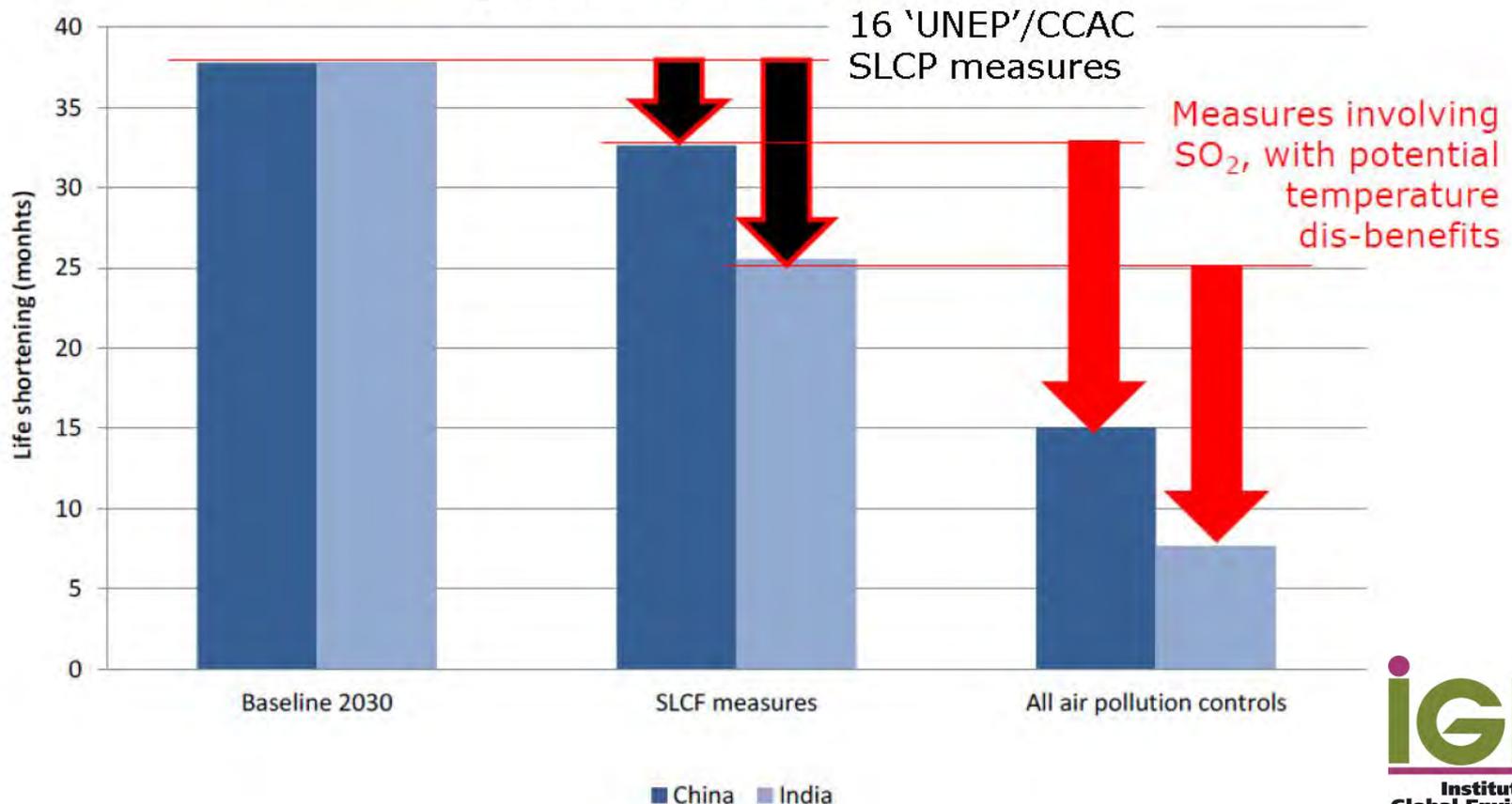
# MULTIPLE BENEFITS OF INTEGRATED POLICIES



Source: McCollum, Krey, Riahi, 2012

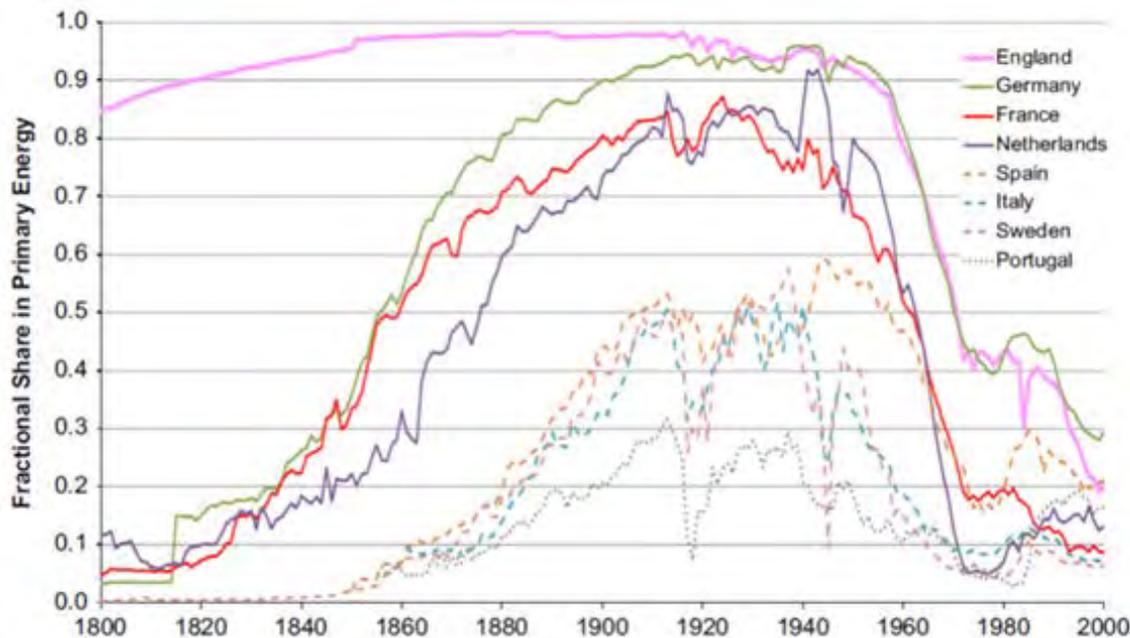
# CO-BENEFITS: IMPROVING AIR QUALITY AND TACKLING CLIMATE CHANGE

Loss in statistical life expectancy from PM2.5 in 2020  
(Source: GAINS-Asia)



# ALTERNATIVE PATHWAYS TOWARD SUSTAINABLE DEVELOPMENT AND CLIMATE STABILIZATION (ALPS)

## Diffusion of Coal Power Plants (ALPS 2014)

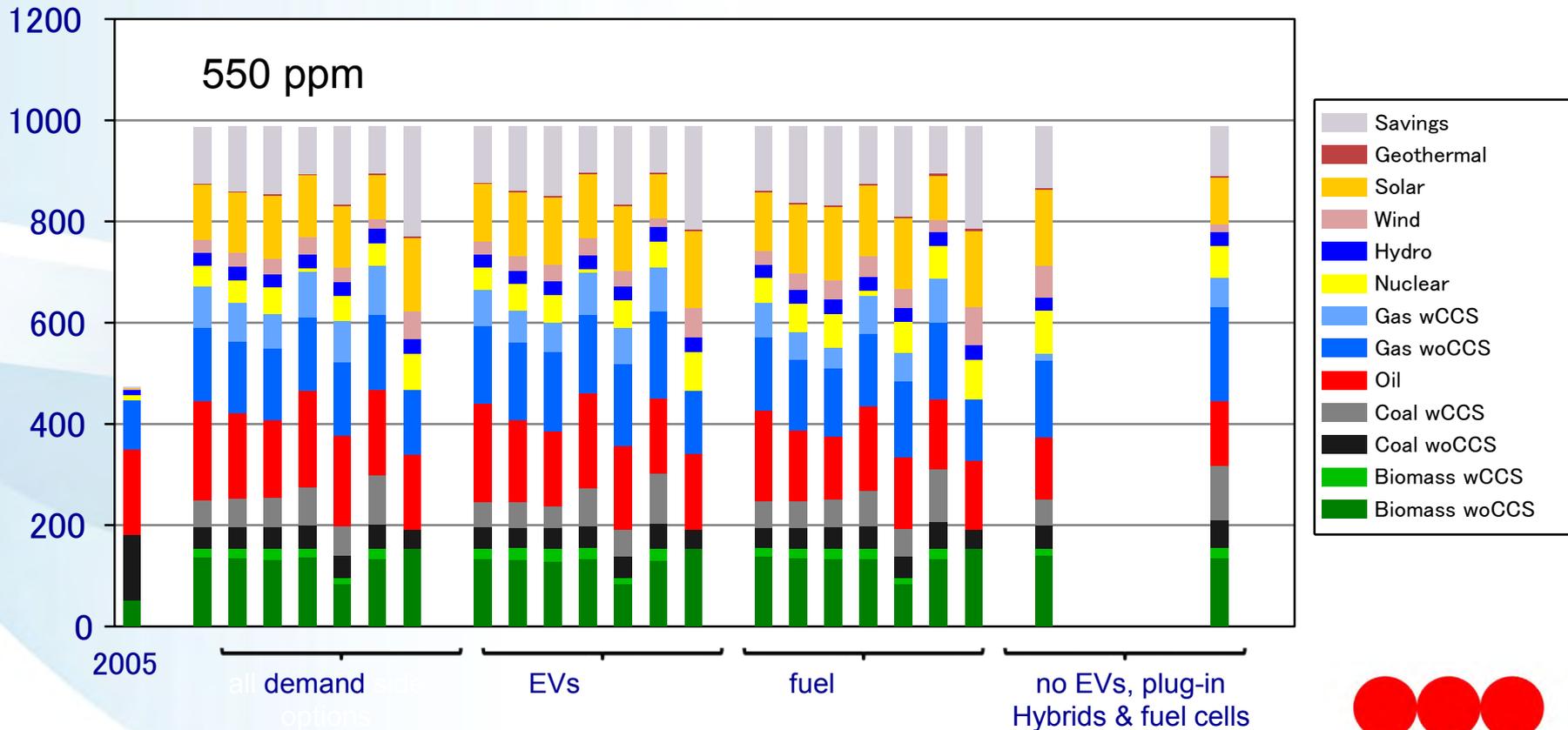


## TOPICS:

- ✓ Energy security
- ✓ Technology diffusion
- ✓ New Concepts for technological learning
- ✓ Actor heterogeneity & behavior

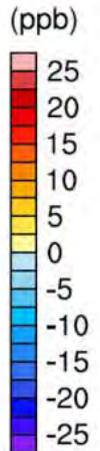
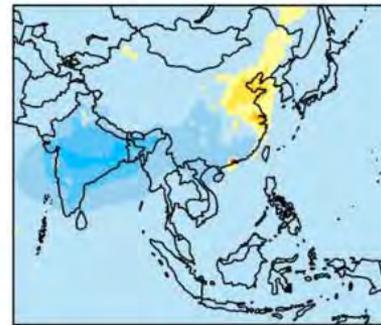
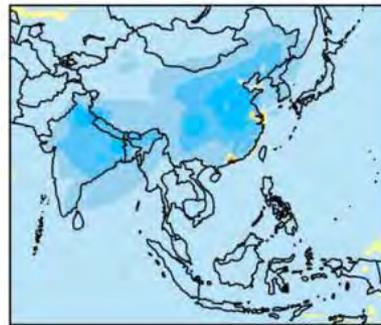
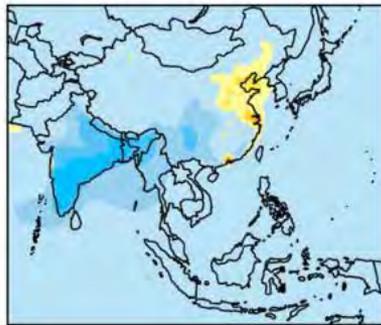
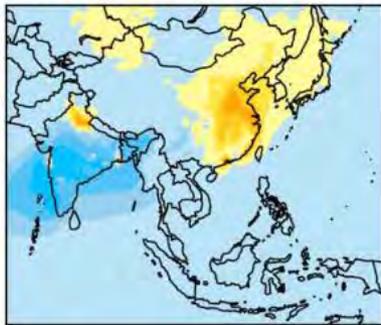


# POTENTIAL FOR GLOBAL ELECTRIFICATION TO REDUCE GREENHOUSE GAS EMISSIONS

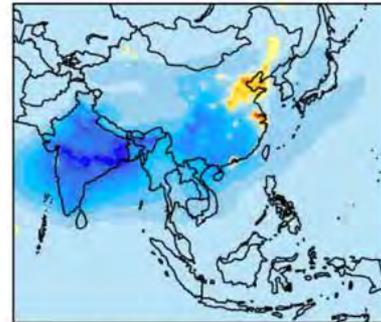
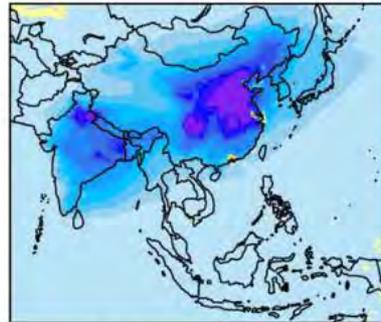
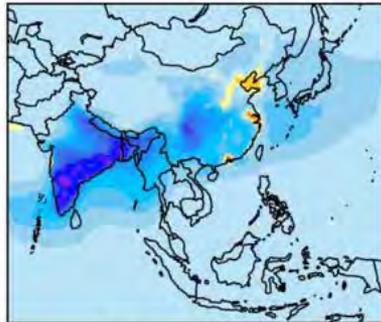
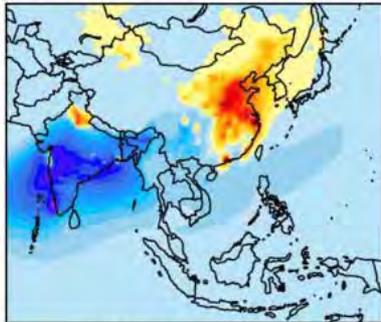


# FUTURE PREDICTION OF TROPOSPHERIC OZONE OVER SOUTH AND EAST ASIA IN 2030

(a) PC0-BAU0



(b) PC1-BAU0



Winter (DJF)

Spring (MAM)

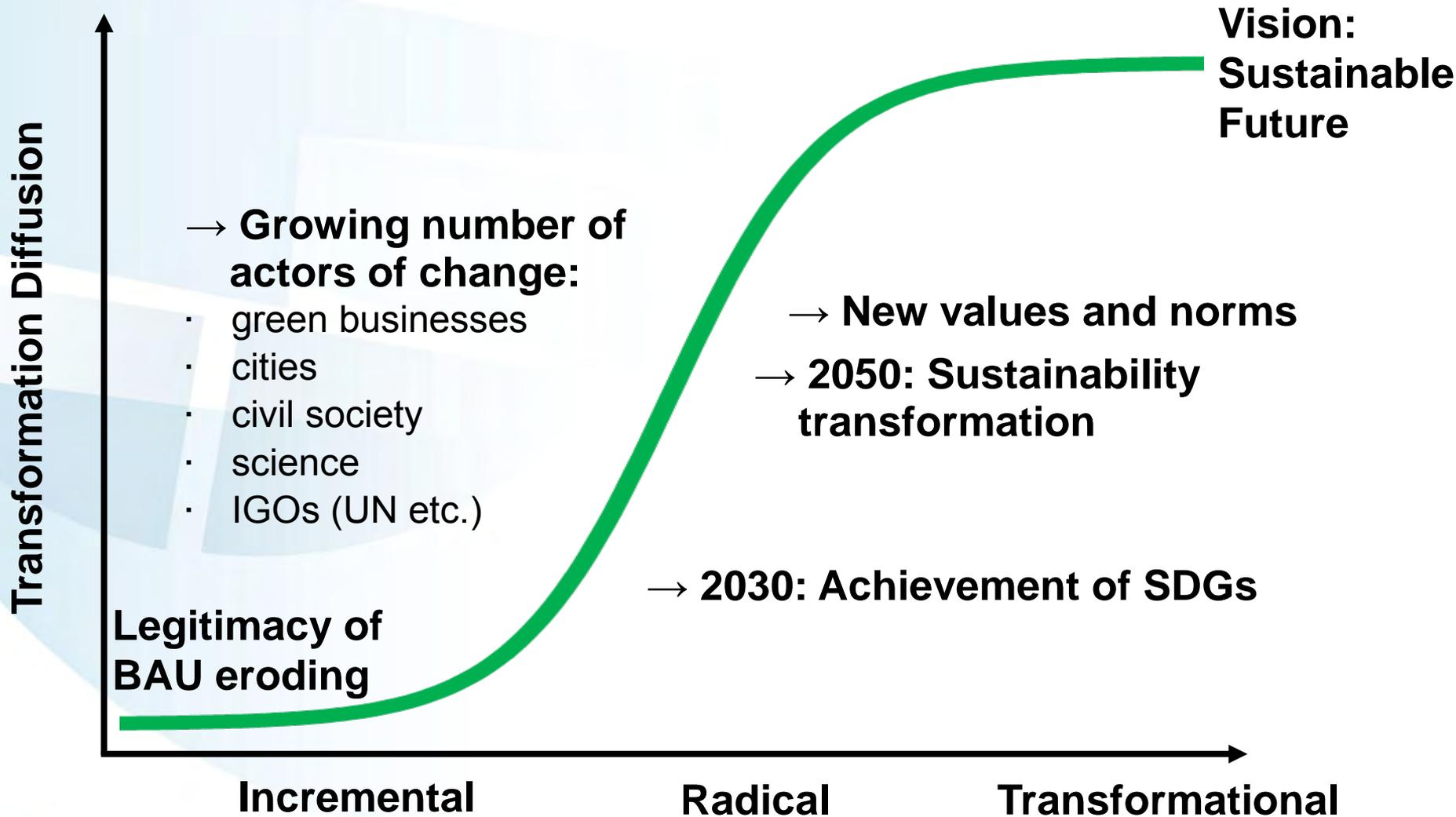
Summer (JJA)

Autumn (SON)



# The World in 2050 (TWI2050.com)

“Doing More with Less” within Planetary Boundaries



Source: After WBGU, 2011

# The World in 2050 (TWI2050.com)

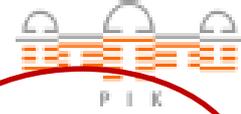
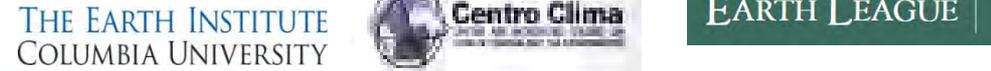
“Doing More with Less” within Planetary Boundaries



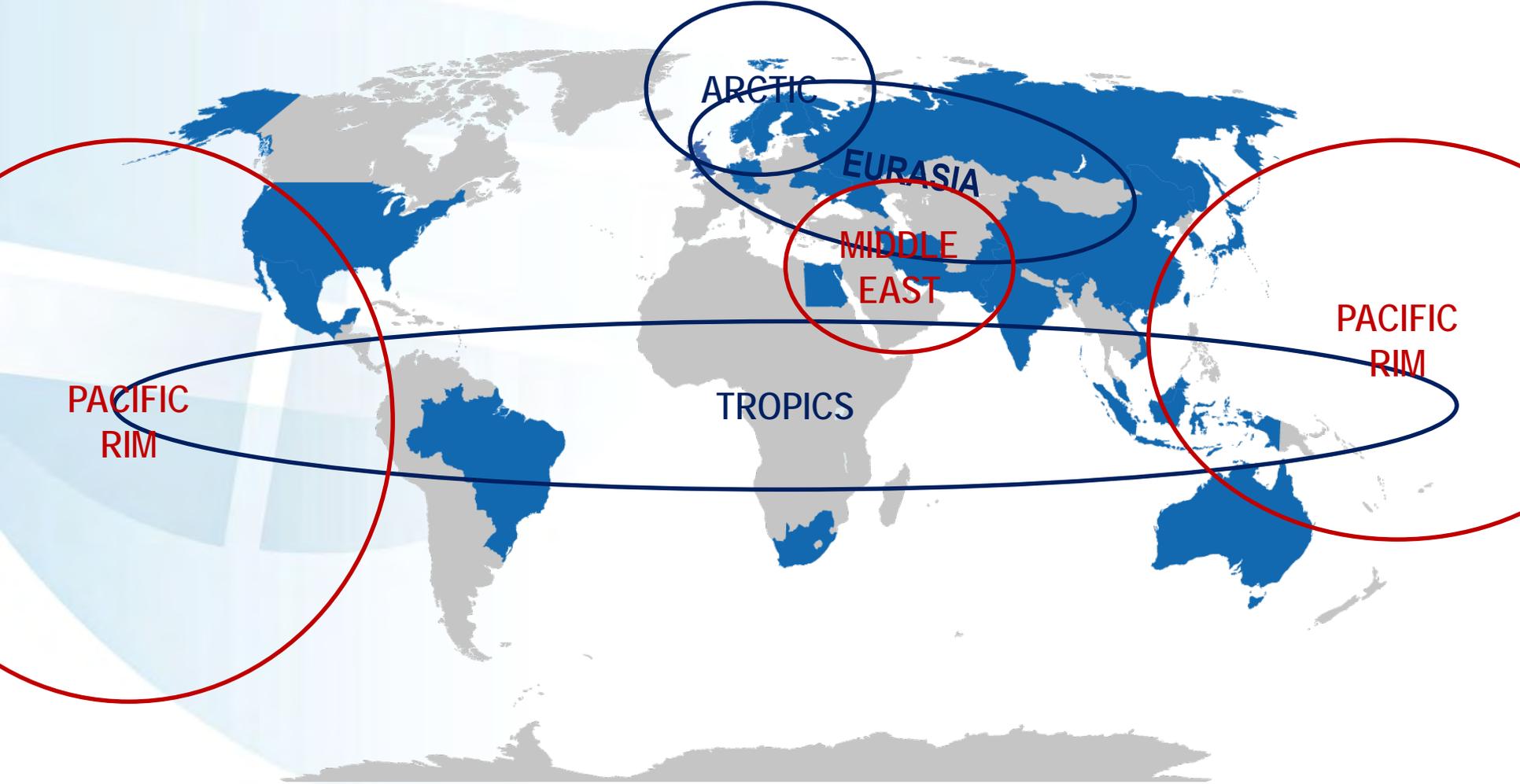
Source: After WBGU, 2011

# The World in 2050 “Consortium”

- AIMES
- Brazilian Federal Agency for the Support and Evaluation of Graduate Education (CAPES)
- Centre for Integrated Studies on Climate Change and the Environment (CIRED)
- Commonwealth Scientific and Industrial Research Organization (CSIRO)
- Earth League, whole Earth system modelling initiative
- **Earth Institute, Columbia University**
- Energy Planning Program, COPPE, Federal University of Rio de Janeiro
- Fondazione Eni Enrico Mattei (FEEM)
- Future Earth
- German Development Institute (DIE)
- Global Ocean Ecosystem Dynamics (GLOBEC)
- Indian Institute International Futures
- Indian Institute of Technology (IIT)
- International Energy Agency (IEA)
- International Food Policy Research Institute (IFPRI)
- International Monetary Fund (IMF)
- **International Institute for Applied System Analysis (IIASA), EUROPEAN COMMISSION**
- Intergovernmental Panel on Climate Change (IPCC)
- Joint Research Centre, European Commission
- Joint Global Change Research Institute at Pacific Northwest National Laboratory (JGCRI/PNNL)
- Mercator Research Institute on Global Commons and Climate Change
- National Center for Atmospheric Research (NCAR)
- National Institute for Environmental Studies (NIES)
- National Renewable Energy Laboratory (NREL)
- Organisation for Economic Co-operation and Development (OECD)
- Potsdam Institute for Climate Impact Change (PIK)
- PBL - Netherlands Environmental Assessment Agency
- Research Institute of Innovative Technology for the Earth (RITE)
- Stanford University
- **Stockholm Resilience Centre**
- **Sustainable Development Solutions Network (SDSN)**
- The City University of New York (CUNY)
- Tsinghua University
- UN Population Division
- UN DESA
- UNEP- World Conservation Monitoring Centre (UNEP-WCMC)
- University of Hamburg
- World Bank



# ASIAN PACIFIC REGIONAL APPROACH?



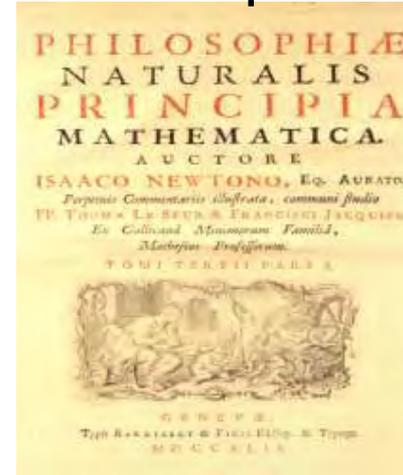
# What type of science and scientific collaboration do we need?



Sir Isaac Newton



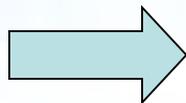
## Principia



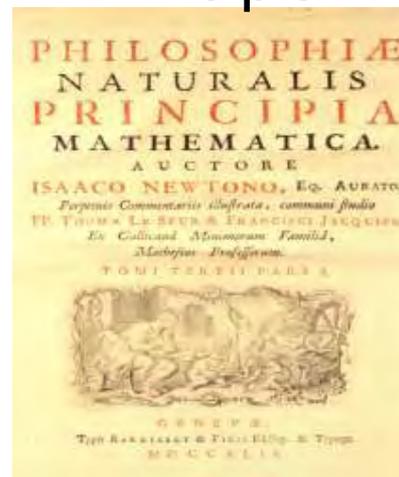
# The Renaissance vision



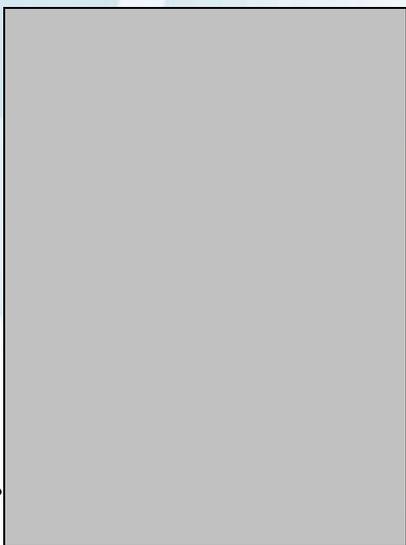
Sir Isaac Newton



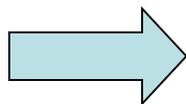
## Principia



# The Anthropocene vision



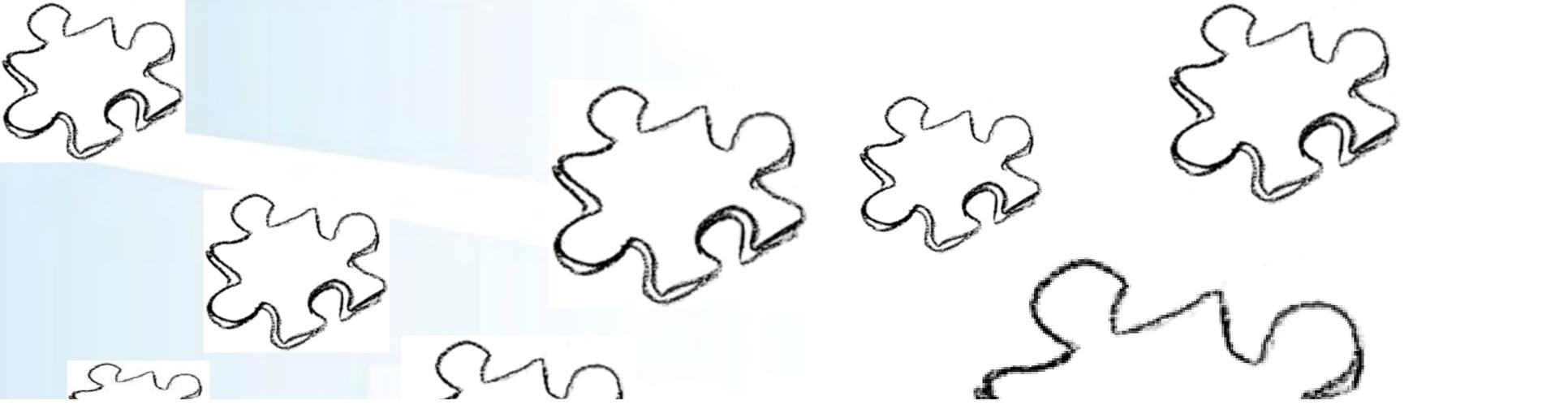
?????



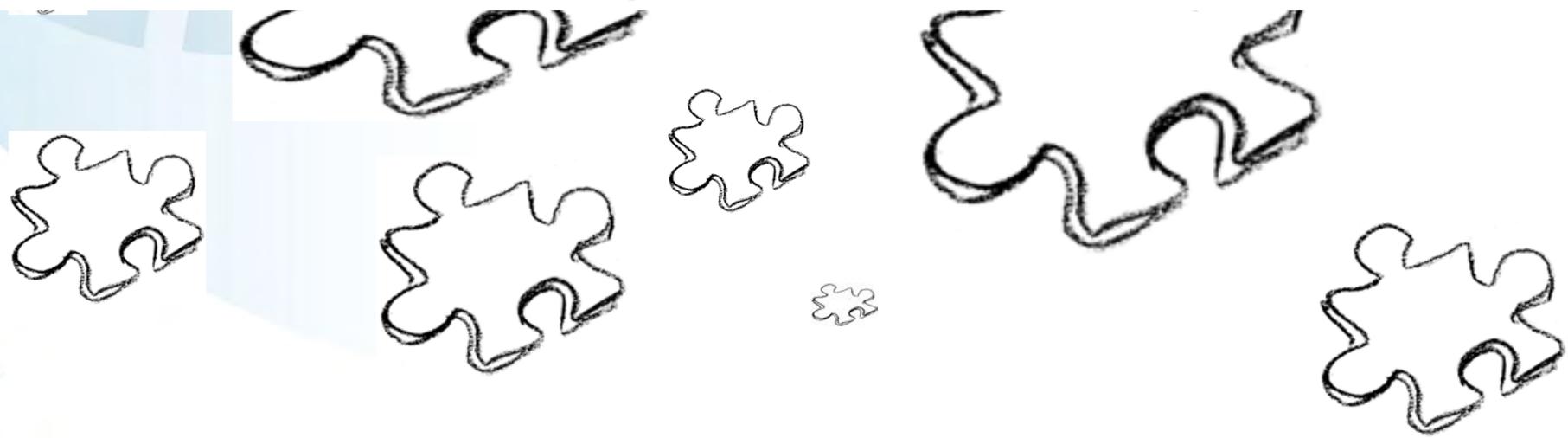
## Terrestris Rationis Principia







**...system thinking and integrated approaches help to put the puzzle together....**





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at IIASA (again)!

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