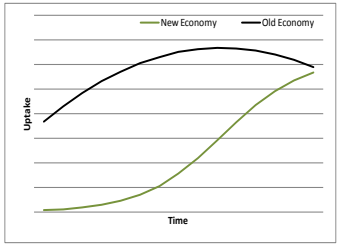
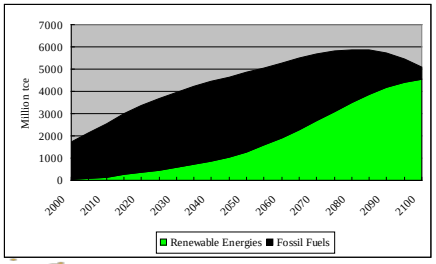




Manufacture renewables to build energy security

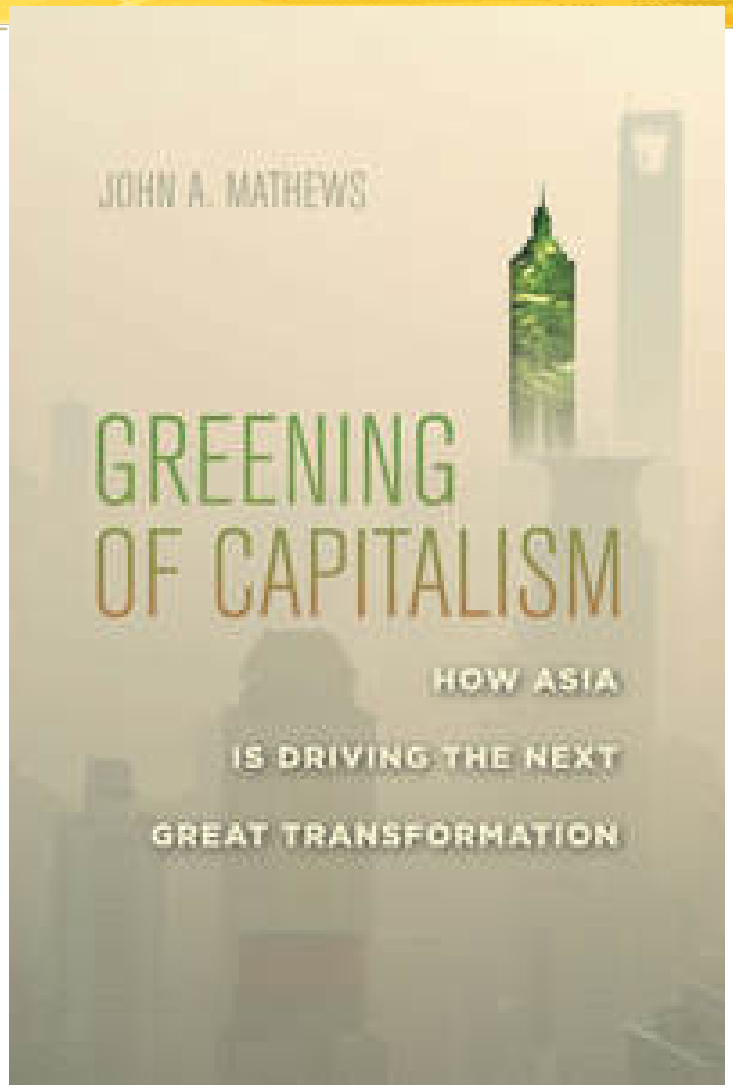
Professor John A. Mathews

Professor of Strategy, MGSM, Macquarie University, Sydney

Japan Renewable Energy Foundation
Tokyo

March 2015

Greening of Capitalism: How Asia is Driving the Next Great Transformation



Industrial dynamics perspective: Why renewables provide the best form of 'energy security'

The green transition – in many ways, the biggest business transition there has ever been, the **biggest business opportunity of 21st century**

But what dominates debate is a mainstream economics perspective – carbon taxes; cap and trade; a cost-based perspective

Viewing green programmes solely as carbon emissions-reducing vehicles is self-defeating – places programmes outside evolutionary and entrepreneurial business

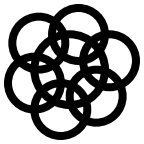
Instead, can view green growth as part of a larger transition

***Renewables are manufactured devices**, and can be utilized anywhere -- energy is harvested, and captures increasing returns

*Renewable power viewed not as a carbon-reducing technology, but as based on manufacturing – thereby enhancing energy security

Renewables: a powerful source of energy security

But Japan has not yet committed to renewables



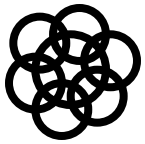
China has committed to renewables

China now adding 50 GW of renewable power (water, wind, solar: WWS) each year – plus another 30-34GW of thermal/nuclear power
Reverse of situation until recently, when thermal > WWS
Now, WWS > thermal (capacity)
Electric energy generated in 2013: 5,322 billion kW hours
Of which, 20% comes from WWS (two years in advance of goal for 2015)

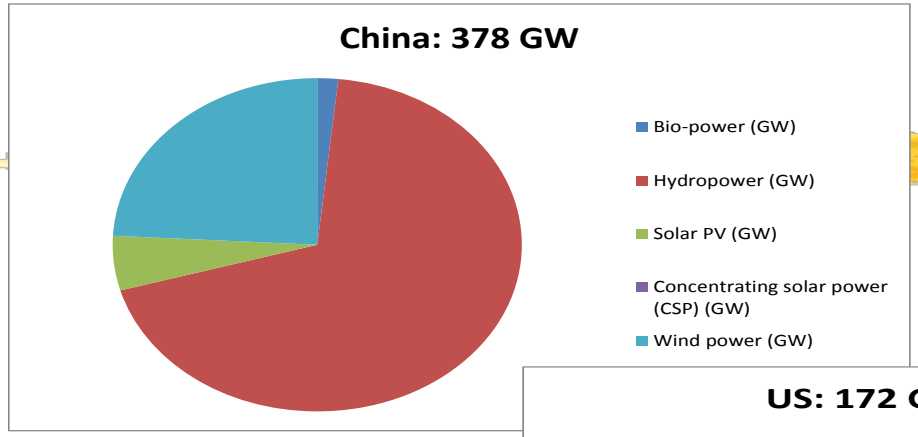
So China's renewable energy generation exceeds entire quantity of electricity generated by German and French power systems combined

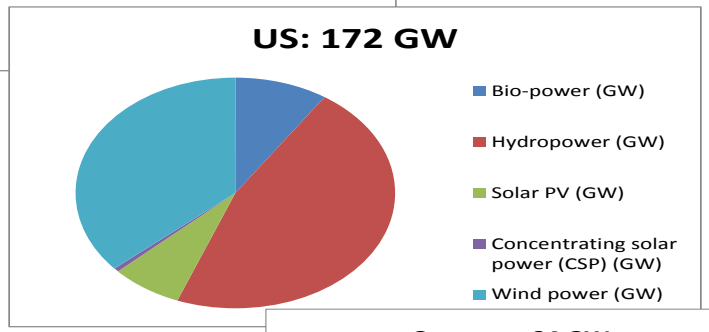
China's pursuit of renewables (to complement its coal-based power) is not a moral imperative, **but an economic imperative**

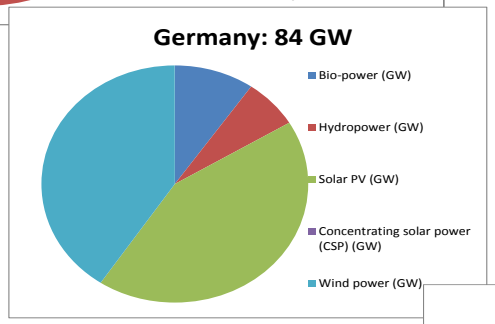
World's largest energy transition is under way
How? Why? What is the strategy?

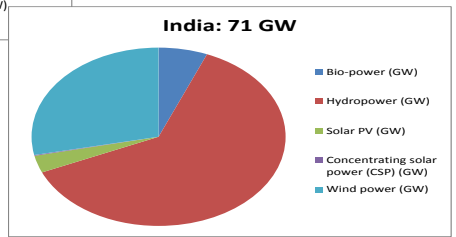


China’s renewable power system cf others

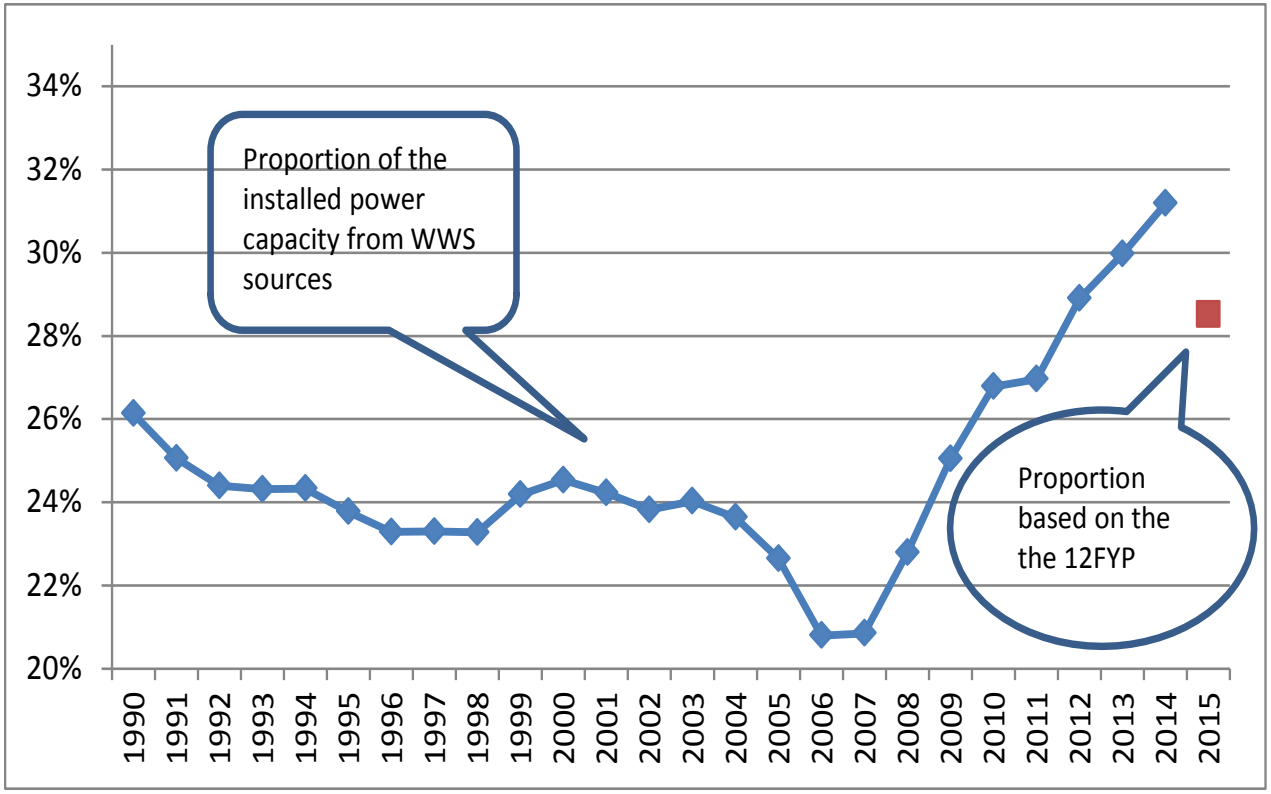




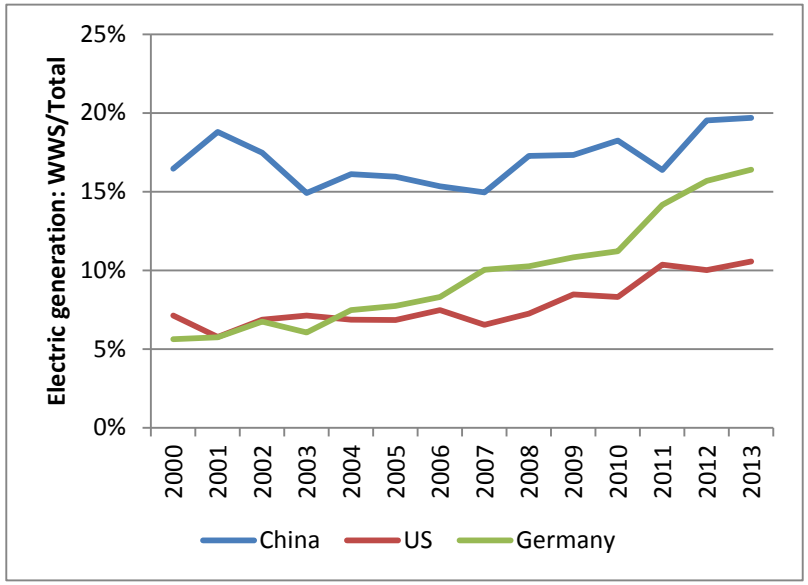




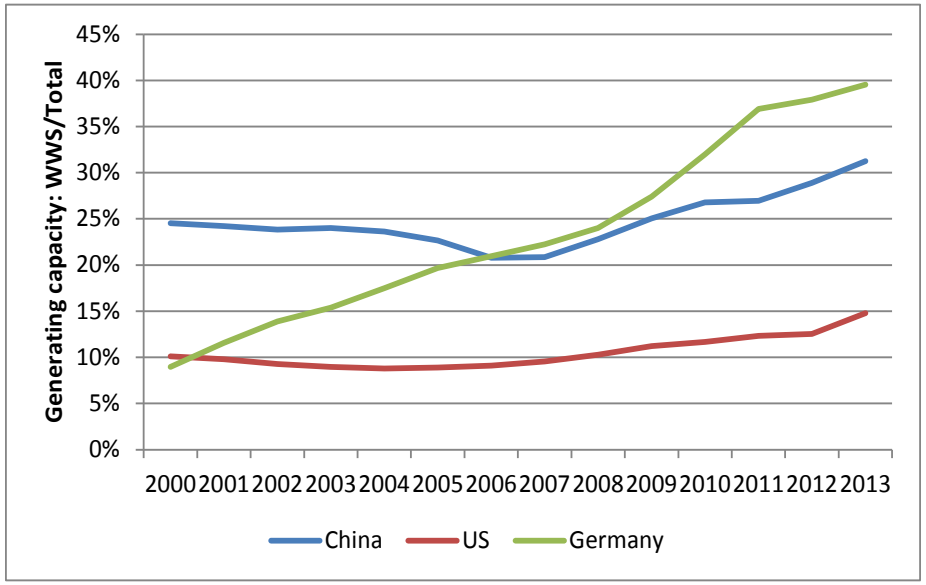
Trends in WWS/electric generation capacity (%): China



Historical trends in WWS/electric generation: US, China, Ger

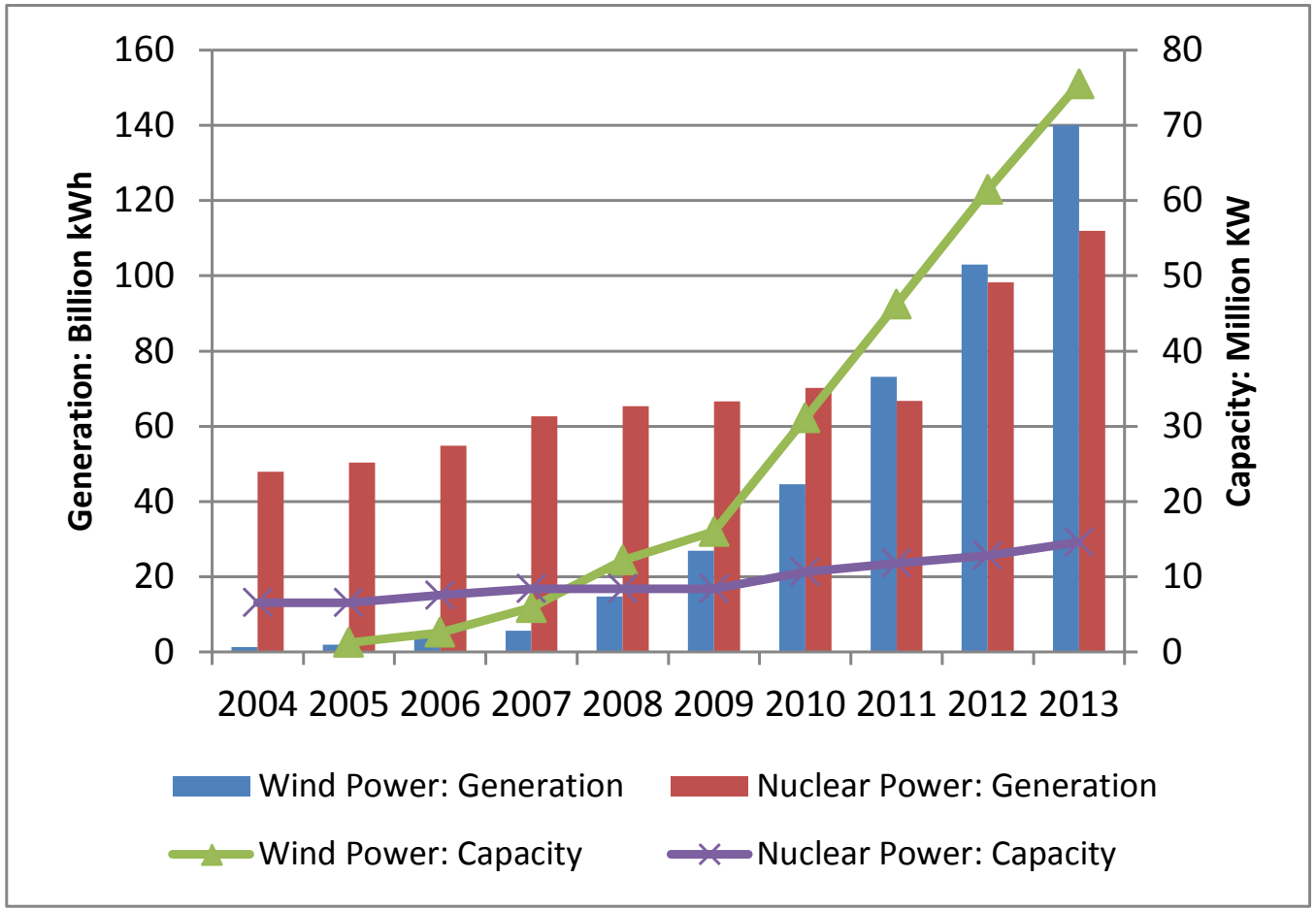


A. Electric energy generated

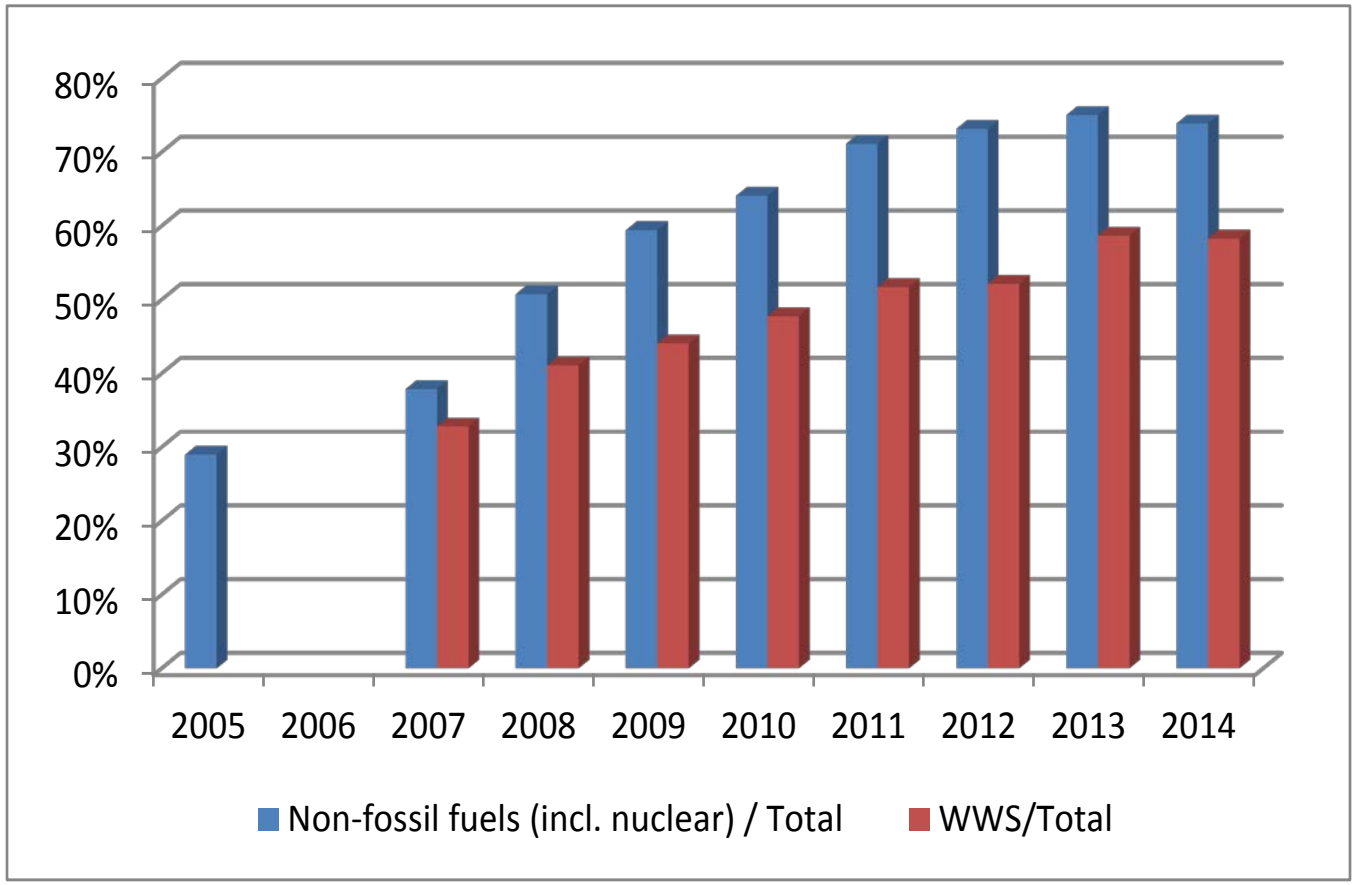


B. Power capacity

China: wind vs nuclear power

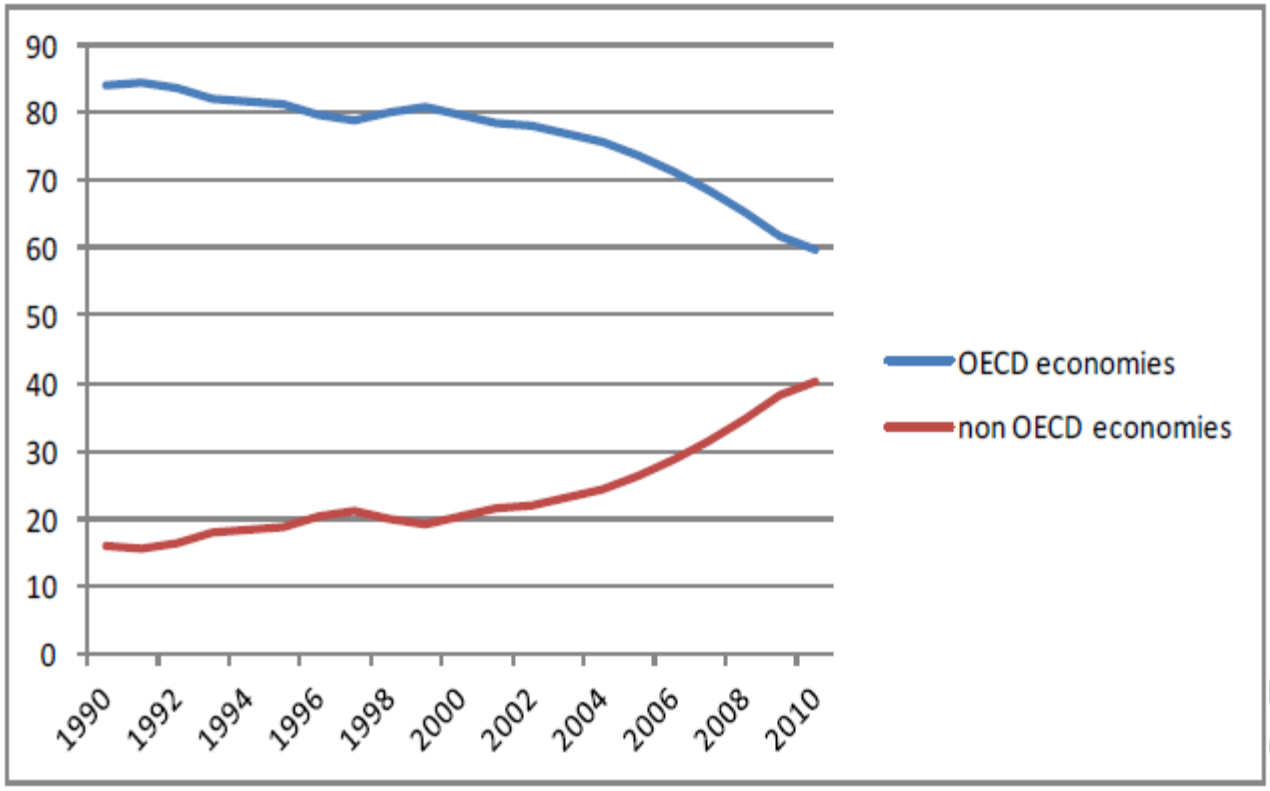


Historical trends in WWS/electric generation investment (%): China



Shifting Wealth: Manufacturing is shifting East

Share of manufacturing industry value added in total world manufacturing value added, 1990-2010



OECD DEVELOPMENT CENTRE

SOURCE: OECD Development Centre based on IHS Global Insight, special tabulations (2011) of World Industry Service database.
Note: OECD: no data for Austria, Estonia, Greece, Hungary, Iceland, Luxembourg, Portugal, Slovak Republic, Slovenia.

The issues

Can China (and then India) scale an industrial production system that will lift not just 1 billion people out of poverty, but 5-6 billion?

What would be the implications of China following a BAU pathway – using coal, oil, gas in the way that Western countries did?

Can the ‘western’ industrial model scale in this way? Answer: No

But can an alternative be built, and in time?

Can China go beyond building the largest renewable energy system on the planet?

Or will ‘carbon lock-in’ doom us all?

Can carbon taxes and carbon markets make a sufficiently strong difference?

Can corporate and social responsibility save the system?

How can state intervention drive the transition?

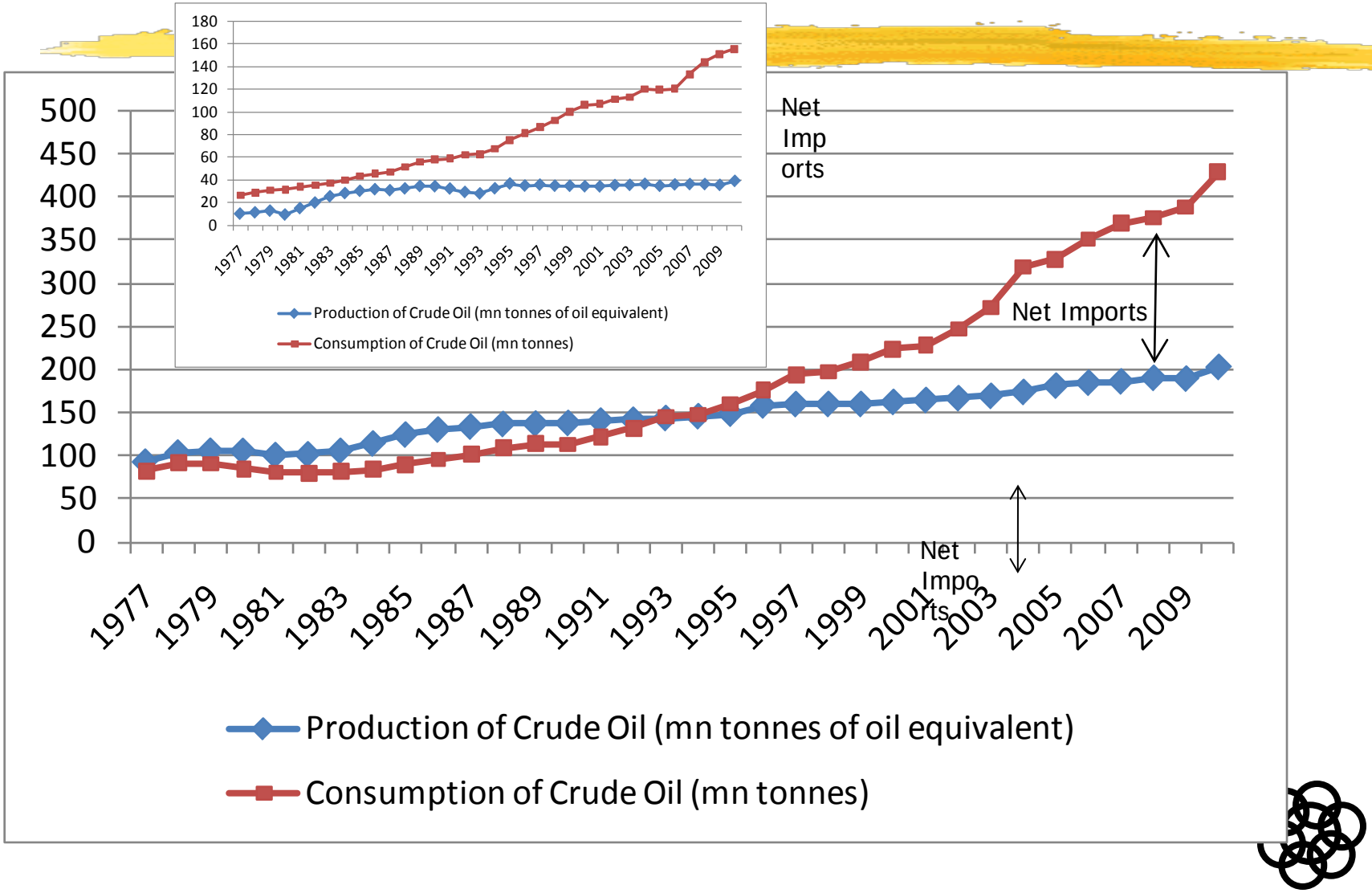
Can Japan join Germany as a leader of the green transition?

Big questions, big issues

First question: Is the fossil fuel era coming to an end?

How can China (and India) gain energy security?

The energy issue and development: China's (India's) looming oil/energy gap



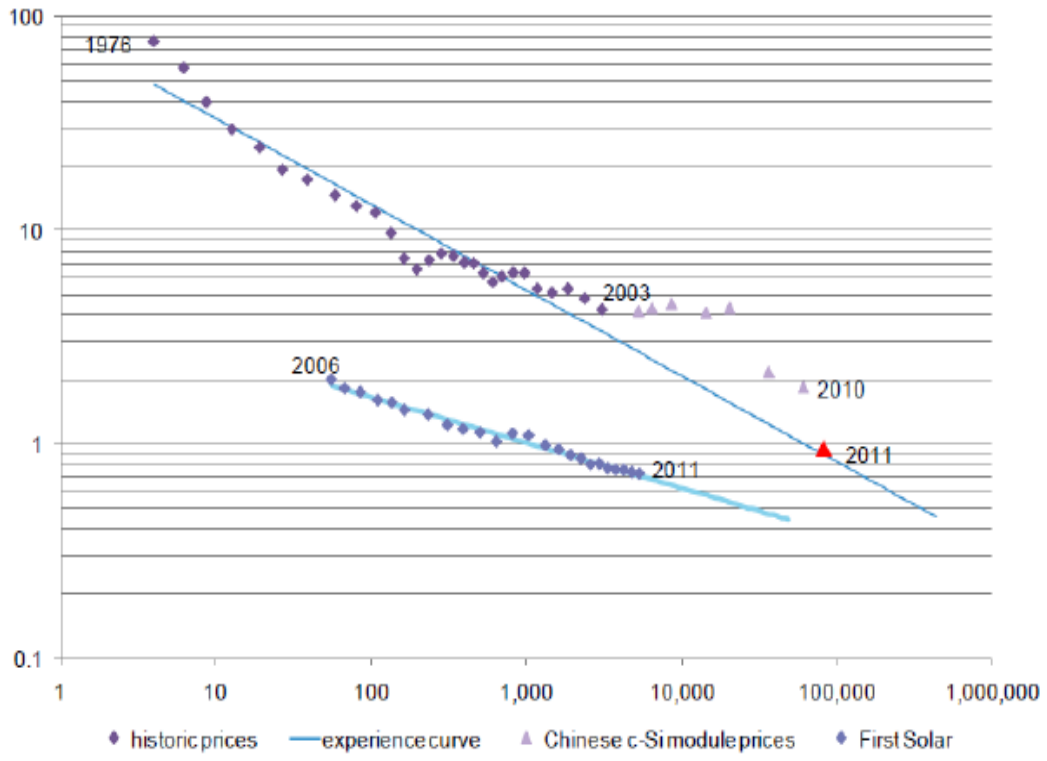
Changes needed: greening of capitalism

Changes called for beyond a mere ‘technical fix’
Beyond the operation of ‘Business as Usual’
Beyond corporate ‘social responsibility’
Beyond the reach of simple instruments like a carbon tax

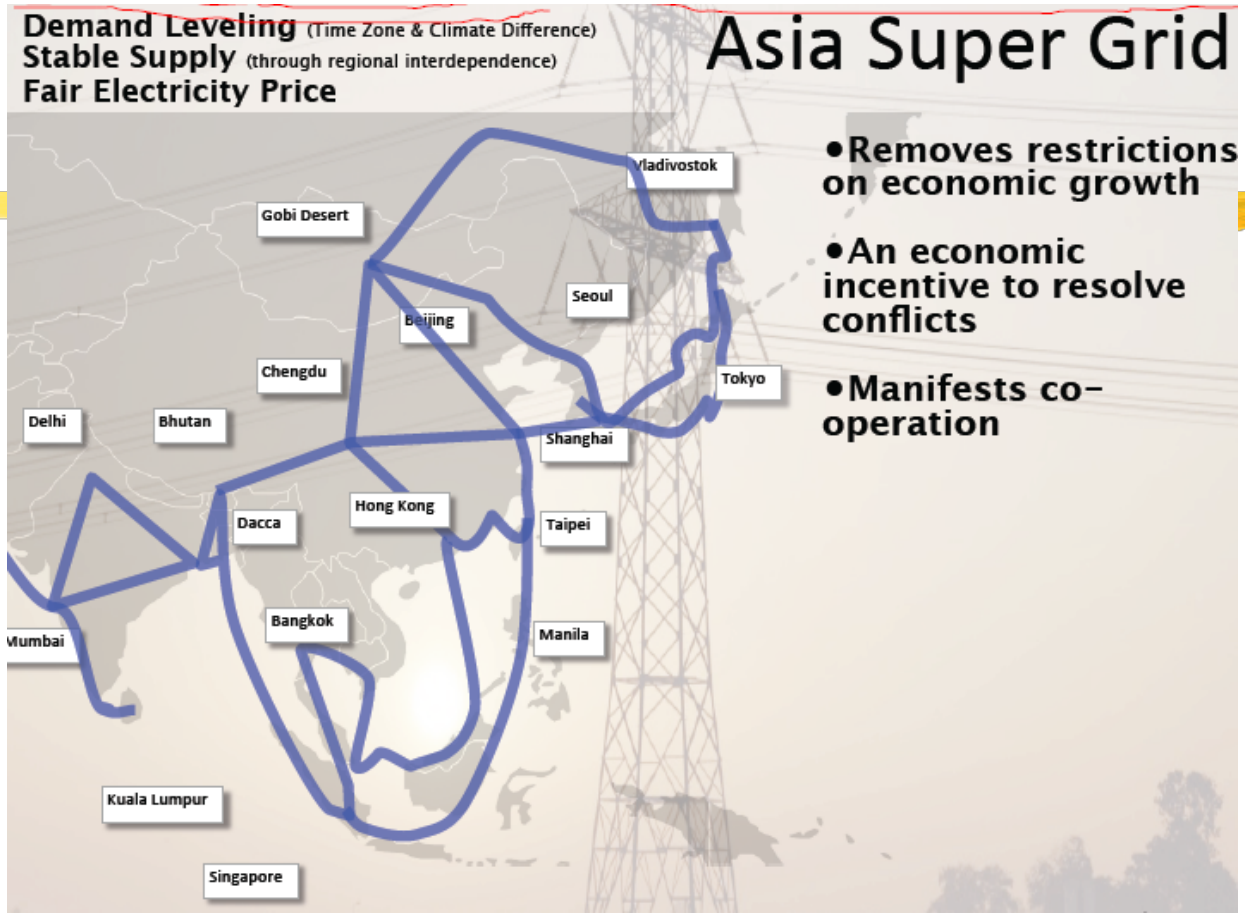
Changes are called for in the three great markets/institutions of industrial capitalism:
•Energy markets – from fossil fuels/nuclear to renewables
•Resources markets – from linear throughput to resource recirculation (Circular Economy)
•Finance – from generic to eco-finance

Business as Usual (BAU) by US and China would lead inevitably to a century of oil wars and resource wars
An alternative industrial model is mandated – even without climate change…
Why feasible? Consider the learning curve

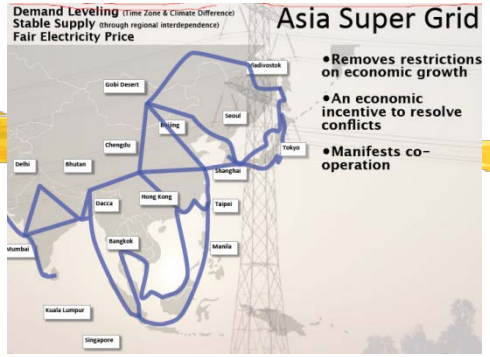
Solar PV becoming universal: Learning curve (BNEF)



Asian Supergrid: Proposal from JREF



Opening up to trade in renewable power



The next step in Asia's energy revolution

Introduces real competition to the international renewable energy system

Breaks domestic power oligopolies

Accelerates diffusion of renewables manufacturing industries

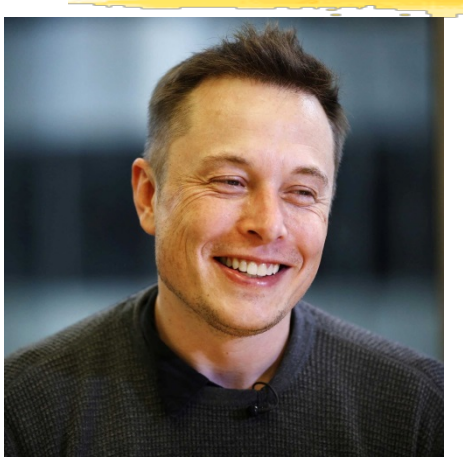
Drives innovation through open competition

Drives cost reduction through open competition

Global impact of China's renewable energy programs

China's expansion of scale drives down costs
Tumbling prices of solar PV, wind and soon CSP
Makes renewable energy a feasible source of power for new industries and for developing countries/regions
Renewables already being utilized for remote mining operations in Chile, now emulated in Australia (displacing diesel)
Renewables now being taken up widely in Central Asia and Africa, e.g. Actis to set up African RE business in Egypt (*FT*, 16 Feb 2015)
These new business deals are possible only because China has driven down the costs of renewables

World's biggest business opportunity – investing in green industries Who will join these entrepreneurs?



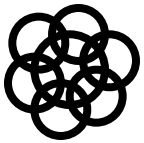
Elon Musk (Tesla Motors);
Wang Chuanfu (BYD);
Masayoshi Son (Softbank

2013: Kexim Green Bond issue

- March 2013 Korean Export Import Bank
- Floats $500 million 5-year bond designated for climate investments
- Targeted at institutional investors (pension funds, SWFs)
- Oversubscribed
- Funds to be channelled to green projects, audited by 3rd party CICERO (Centre for Int Climate and Env Research, Oslo)
- US investors took 47%; European 32%; Asian 21%
- Kexim has AA3 credit rating – bonds carry little risk
- Projects involving Korean firms around the world
- Coupon payments to be made from consolidated revenues

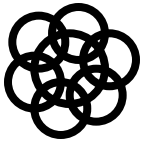
Bonds are serious business – if there is default, this would be counted as sovereign Korean default

Strong discipline for holding to green investment promises



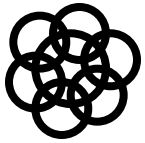
What is driving China's energy revolution – and why can we expect India, Brazil et al to follow?

Climate change is probably least of China's concerns
-- after all, US and Eur created around 80% of the problem
More pressing as a driver is to clean the skies of smog: BIG problem
And to solve China's energy security problem
Oil, gas etc. – from Russia, Saudi Arabia, Venezuela, Nigeria
All geopolitical hotspots – threaten war, revolution and terrorism
Better: Use **manufacturing industries** to build devices that tap into renewable energies and resource recirculation
Apply China's **latecomer catch-up strategy** to energy and resources problem
Building renewable energy industries creates export platforms of tomorrow (12th Five Year Plan) and drives industrial development
This relieves energy insecurity
And it clears skies What is there to lose?



What is driving Japan's energy policy?

Japan grew wealthy in second half of 20th century on basis of manufacturing industries/exports, powered by fossil fuels and nuclear
But rising costs and energy insecurity forcing a rethink
There is a presumption in Japan that renewables are linked to decarbonization, i.e. to climate change mitigation
But what if renewables are viewed as a sound energy policy choice because they generate energy security – because they are manufactured?
Here is a new platform for Japan, and the JREF
Energy security through manufacturing energy systems
And – a convenient truth – manufactured renewables reduce C emission
Renewables play to Japan's strengths as manufacturing nation
Renewables provide export platforms of today and tomorrow
Renewables underpin diffusion of smart communities
And they provide a sound basis for climate diplomacy
What is there to lose?



Renewables: manufacturing, increasing returns, energy security

Renewables, manufacturing and green growth:
Energy strategies based on capturing increasing returns

John A. Mathews [a,*], Erik S. Reinert [b]
a Macquarie Graduate School of Management, Macquarie University, Sydney, NSW 2109, Australia
b Professor of Technology Governance and Development Strategies, Tallinn University of Technology

Dominant perspective frames energy futures and the case for renewables and cleantech in terms of their contribution to mitigation of climate change, as well as cleanliness and absence of carbon emissions. By contrast, energy security is generally discussed in terms of security of access to fossil fuels. In this paper we make a different case for renewables: we contrast the extraction of energy (fuels), which – in spite of technological change – takes place under diminishing returns, with the harvesting of nature's renewable energy, which takes place in a process utilizing manufactured devices, where manufacturing generates increasing returns and costs decline along steep learning curves. This gives a fresh perspective on both renewables and energy security.

Manufacture renewables to build energy security

Countries should follow China's lead and boost markets for water, wind and solar power technologies to drive down costs, say **John A. Mathews** and **Hao Tan**.

Nature 11 September 2014

Is shale oil the alternative source of energy security?

Figure 3: US oil-rig count, 20 January 2012 –28 January 2015

Source: Baker Hughes