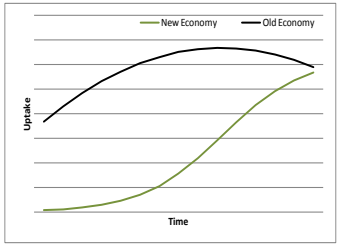
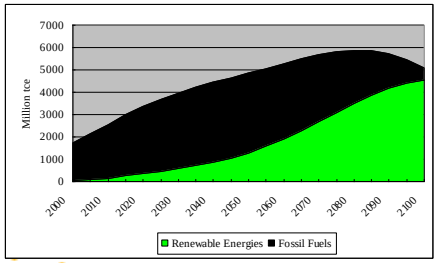




Current developments in China's energy strategy and implications for New Zealand

John A. Mathews

Professor of Strategy, MGSM, Macquarie University, Sydney

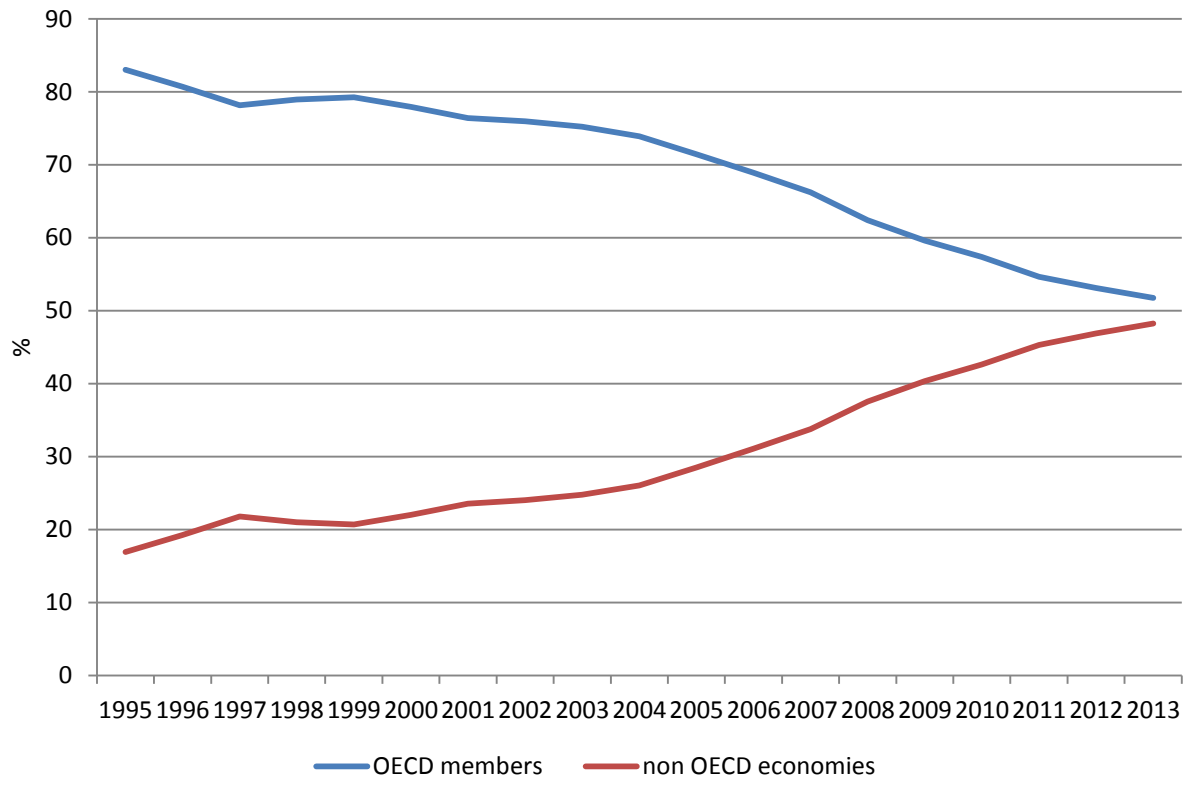
BusinessNZ Seminar

Wellington, NZ

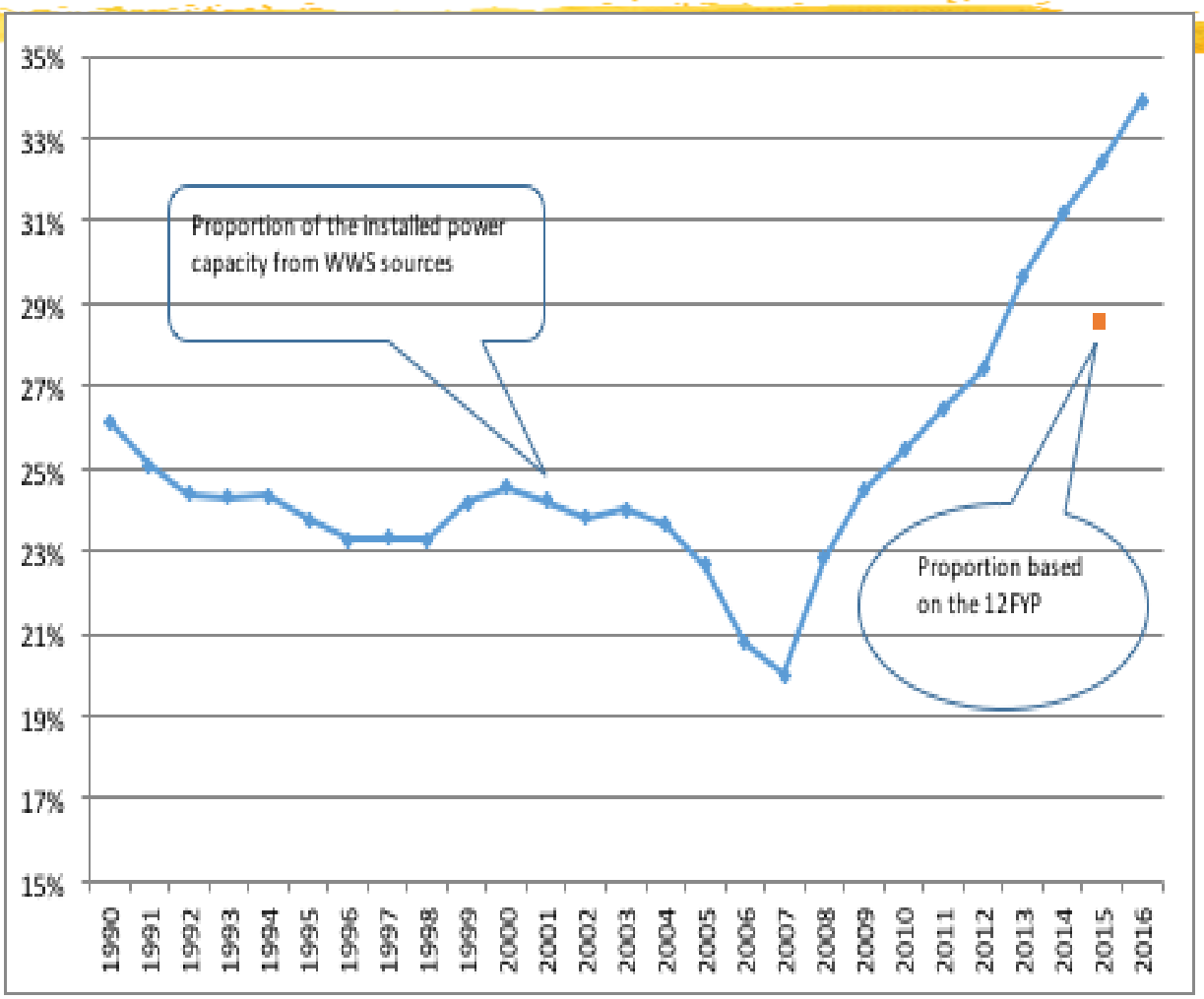
22 September 2017

Shifting Wealth: Manufacturing is shifting East

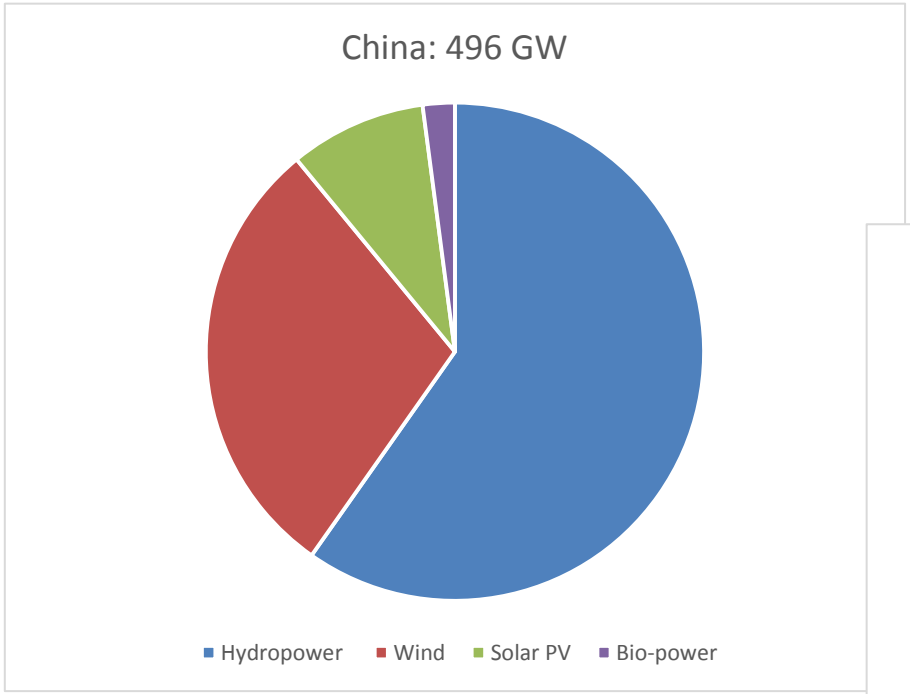
New data from OECD Development Centre

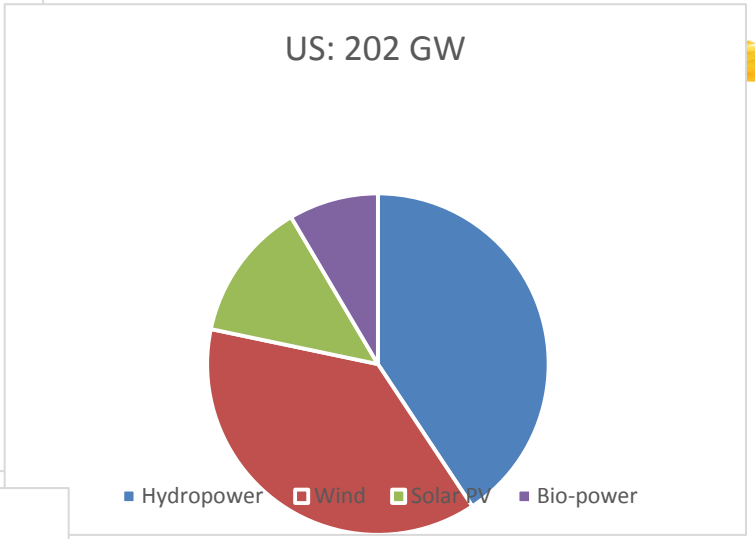


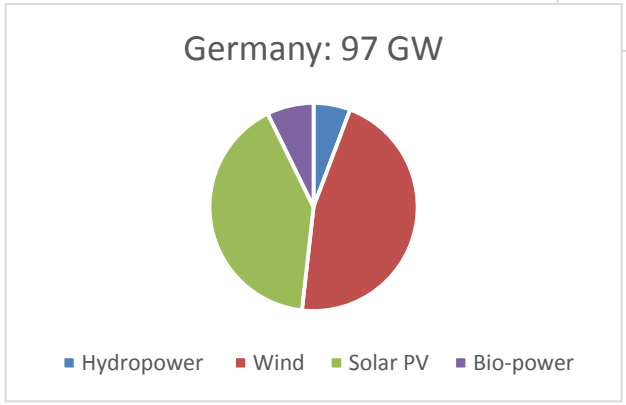
Trends in electric generation capacity: China shifting to WWS

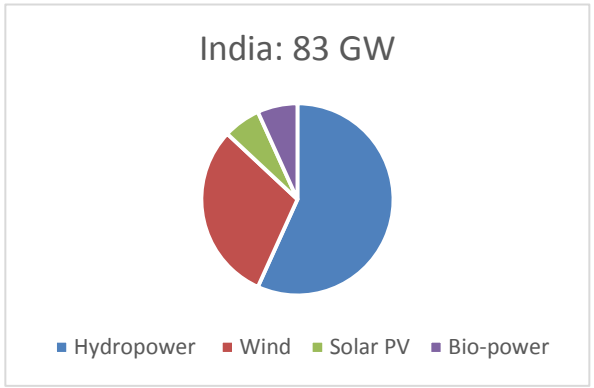


China now a renewables superpower

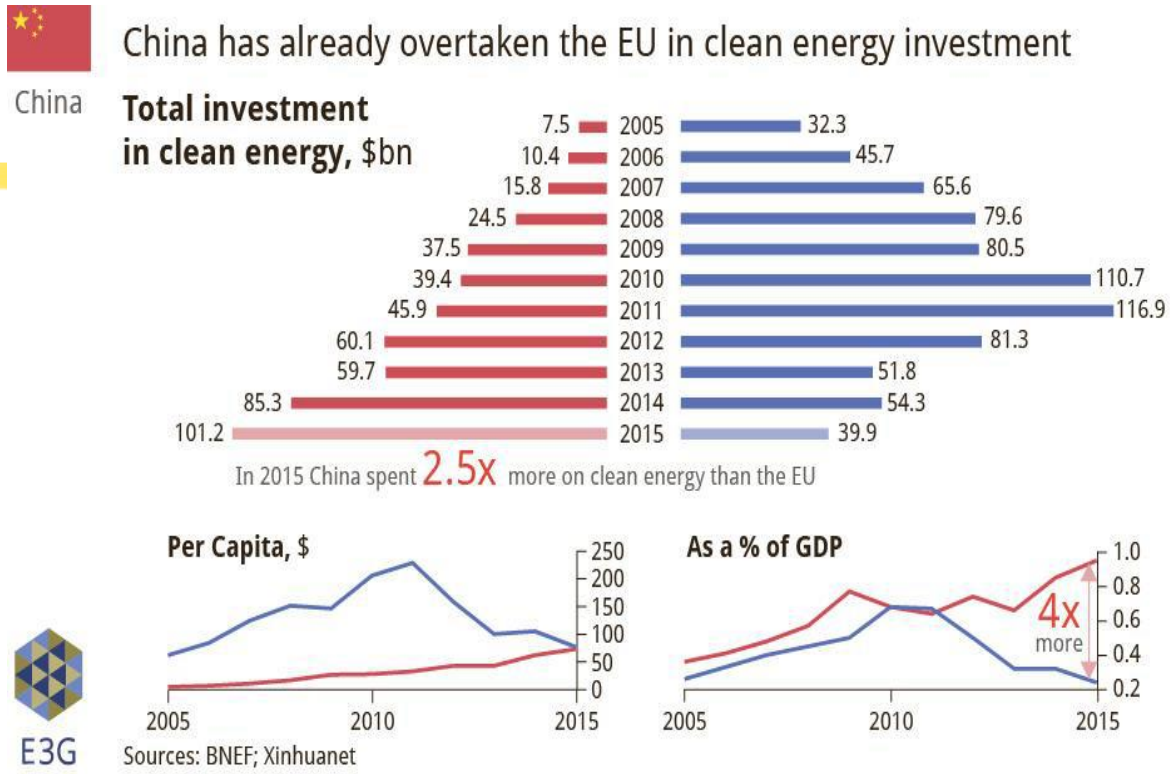






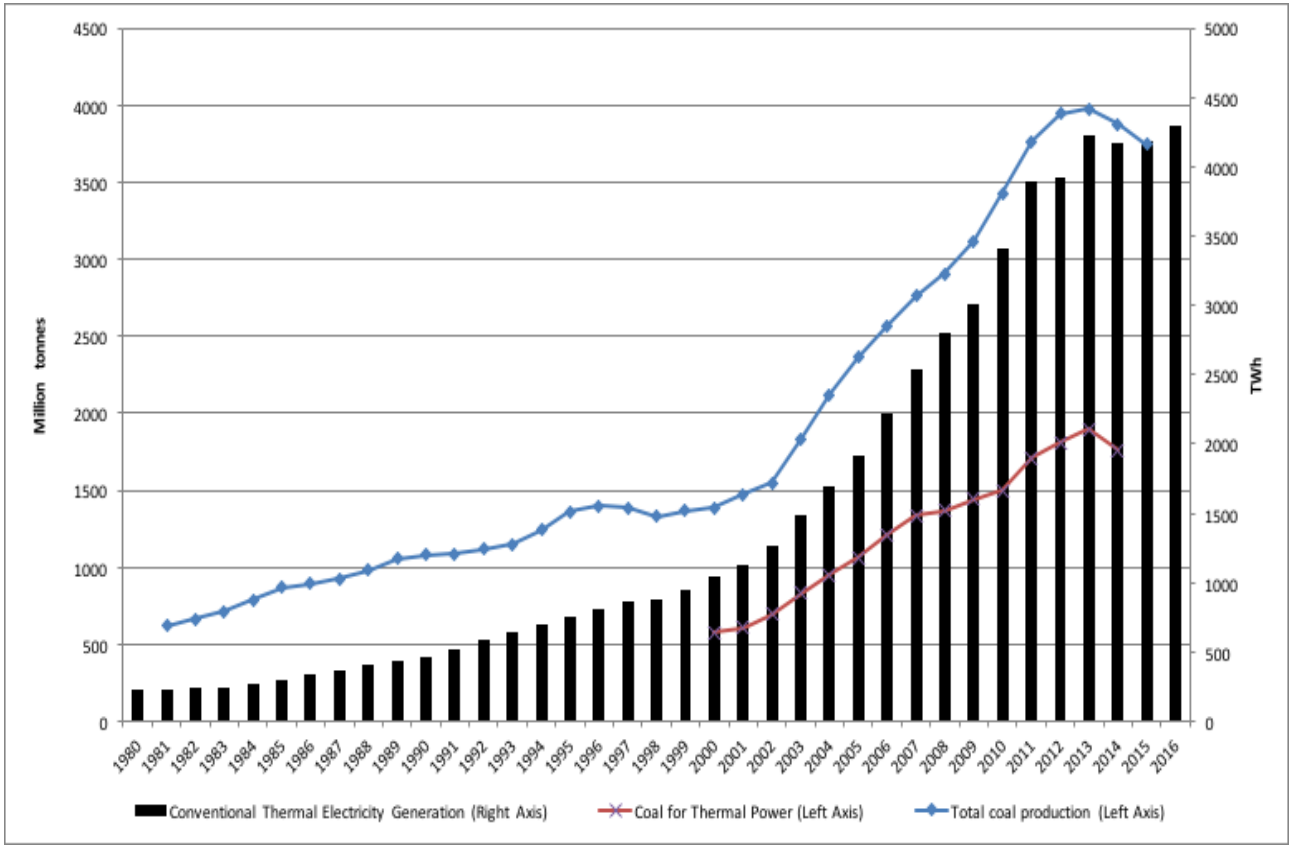


China has already overtaken the EU in clean energy investment

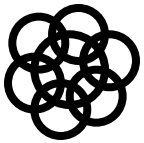


Source: E3G

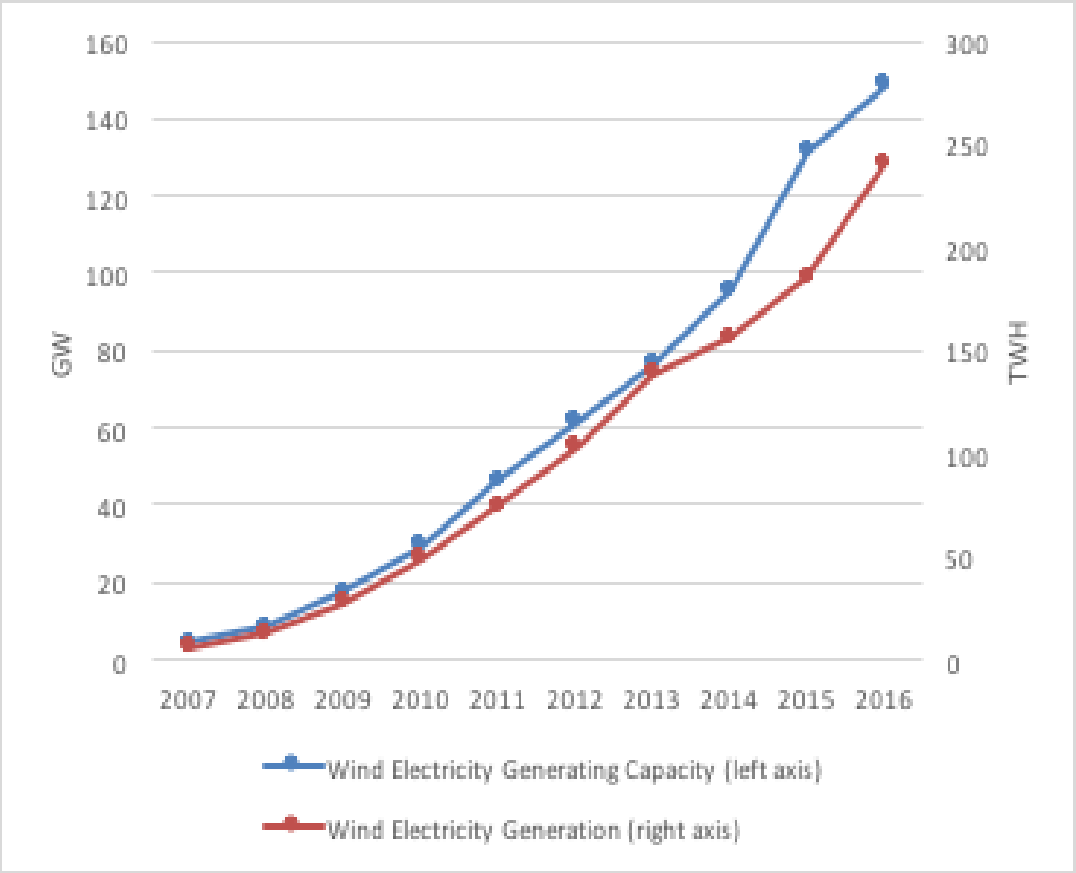
One face of China's transformation: Chinese power generation and rising coal consumption



Source: Mathews & Tan; primary data: US EIA, China Electricity Council

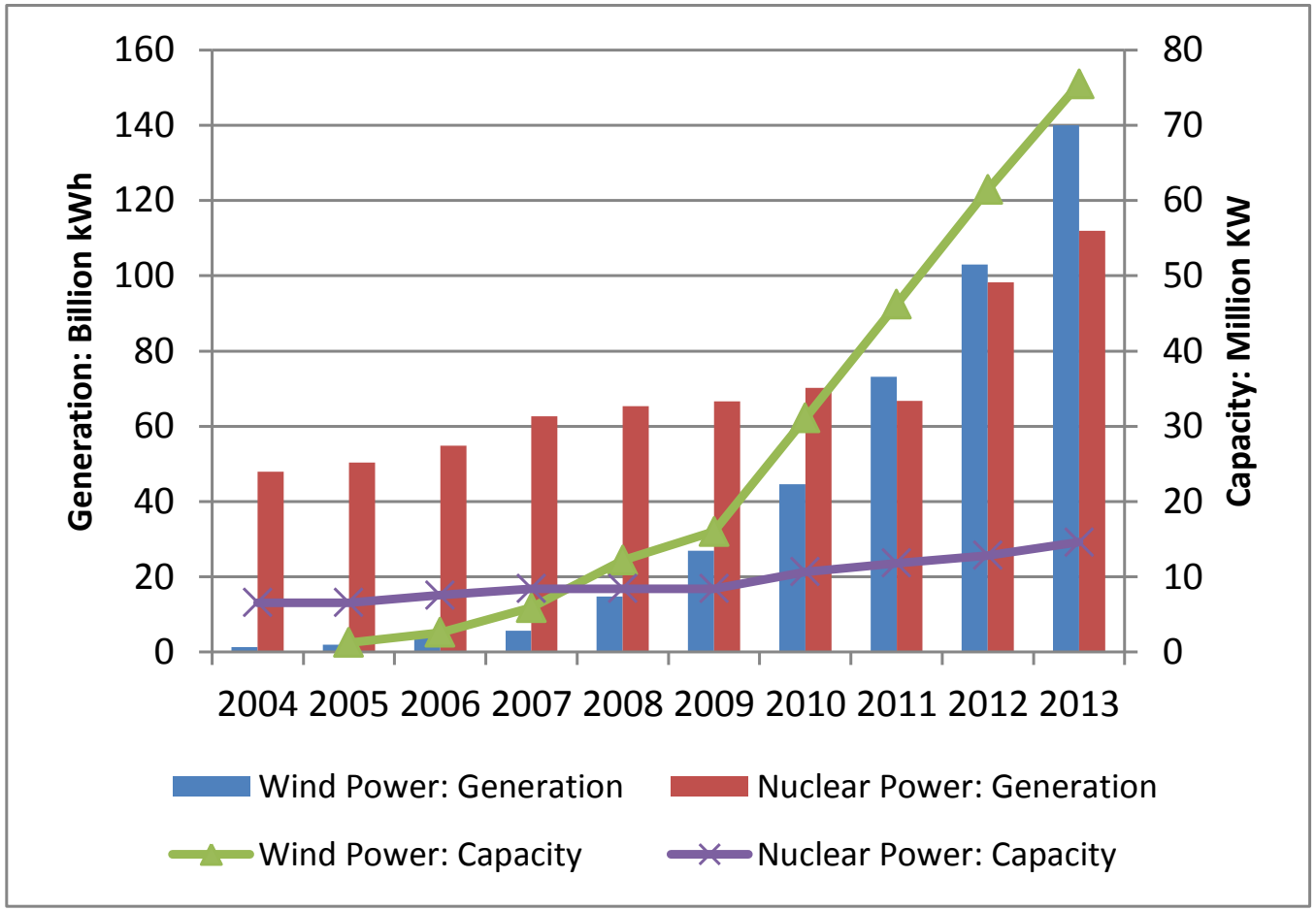


A different (green) face of China: China's build-up of wind power

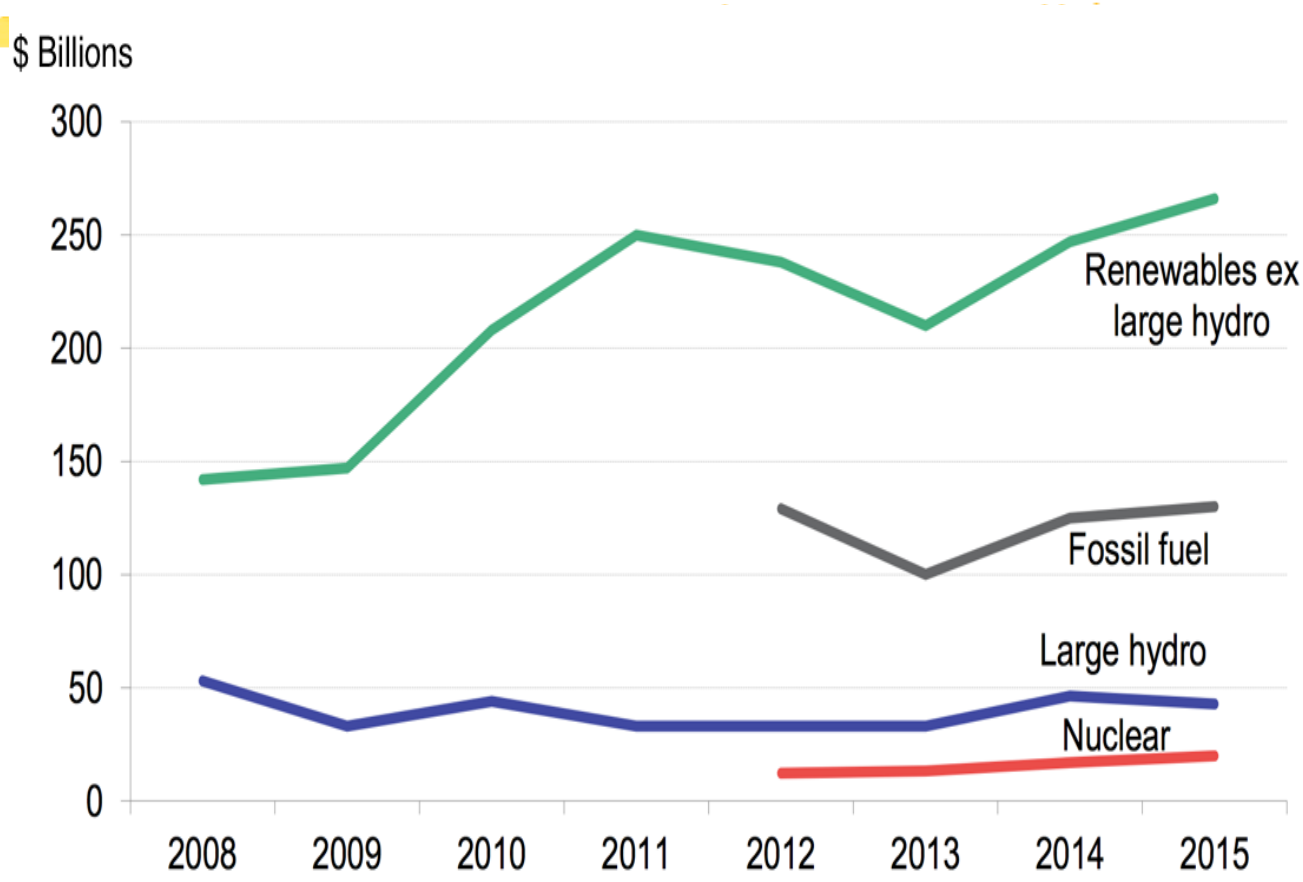


Mathews & Tan: Source of primary data: China CEC

China: wind vs nuclear power

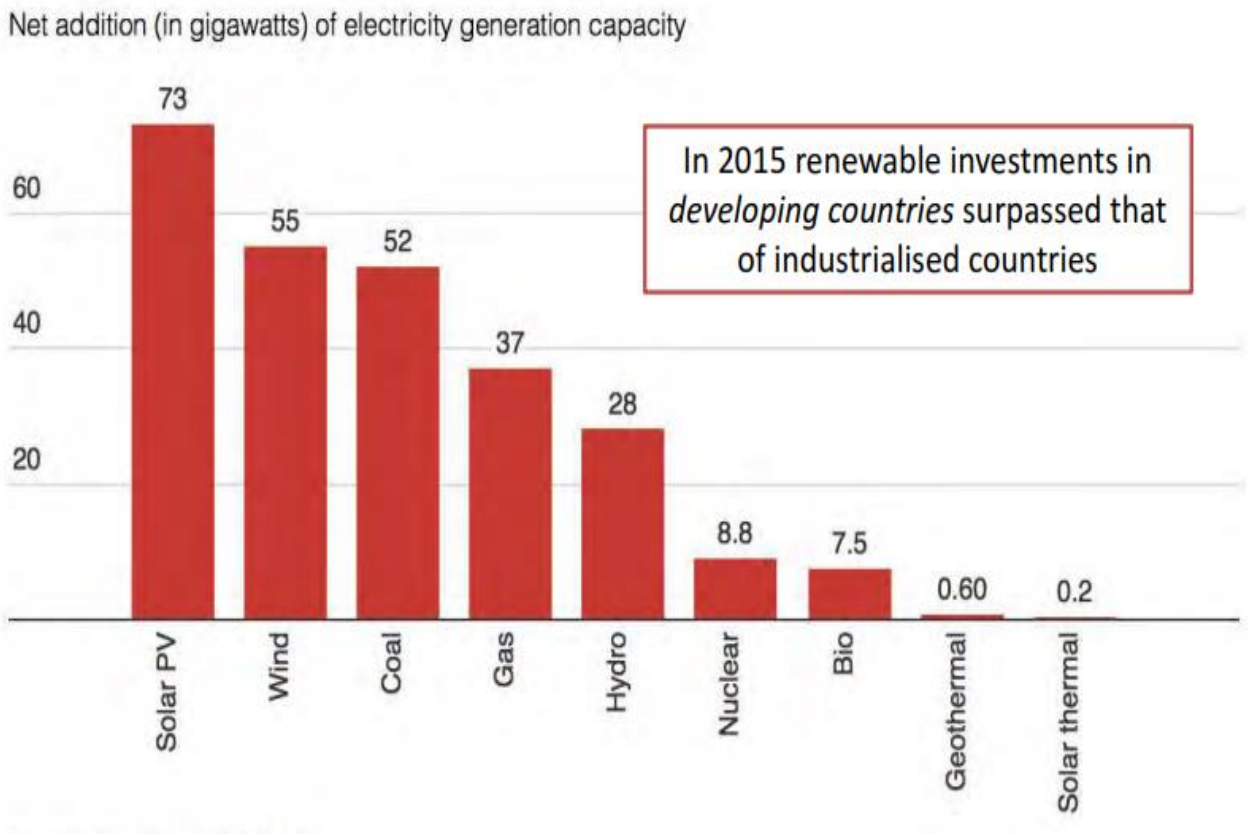


Global investment in power capacity, 2008-2015



Source: BNEF, UNEP

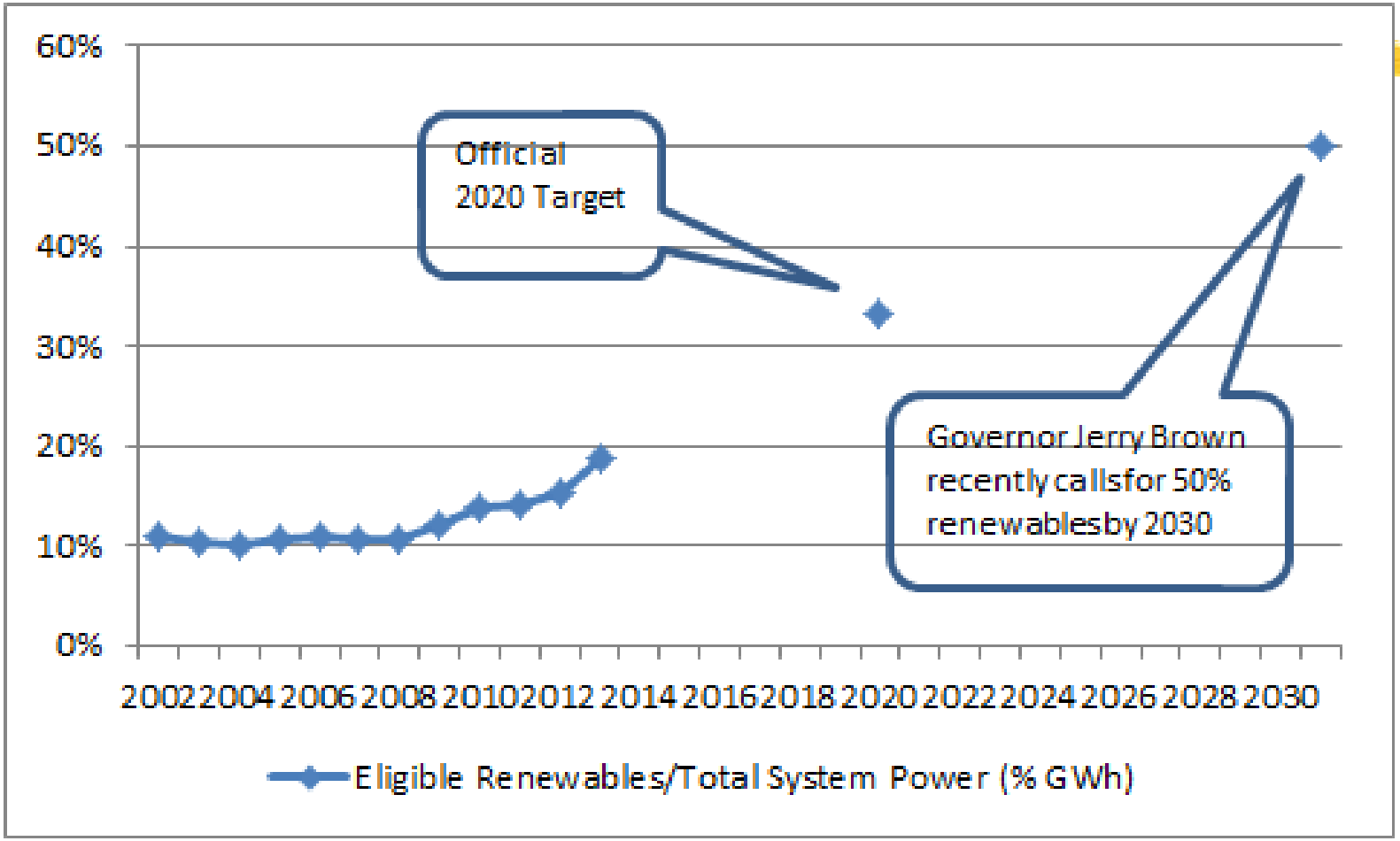
Global new electric power capacity added, 2016



WWS	
Solar	73
Wind	55
Water	28
Total WWS	**156**
Fossil Fuel (FF)	
Coal	52
Gas	37
Total FF	**89**
Nuclear	9

Source: BNEF, UNEP

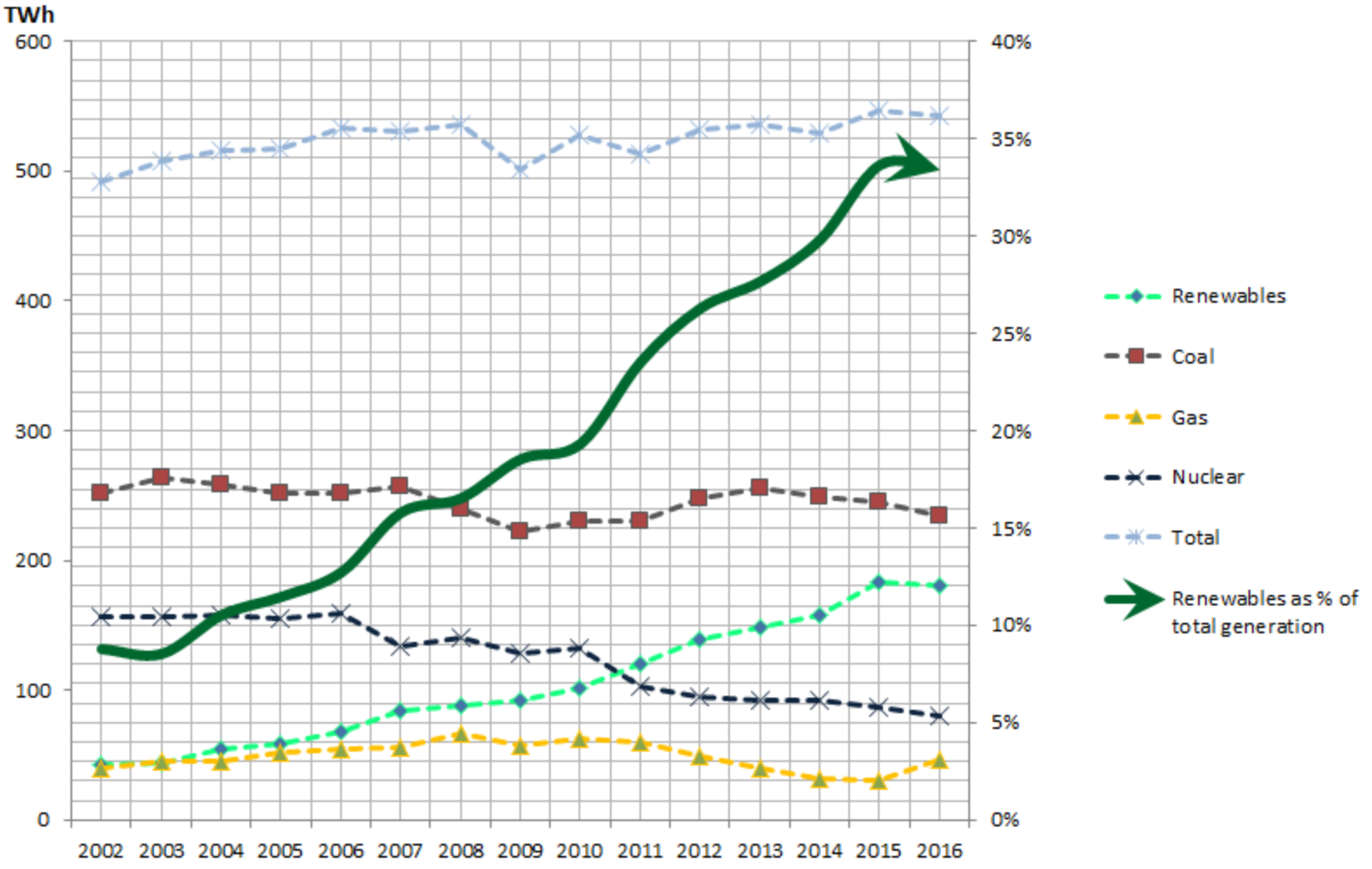
Renewables in California's total power system – but how to reach the target?



Source of primary data: California Energy Commission

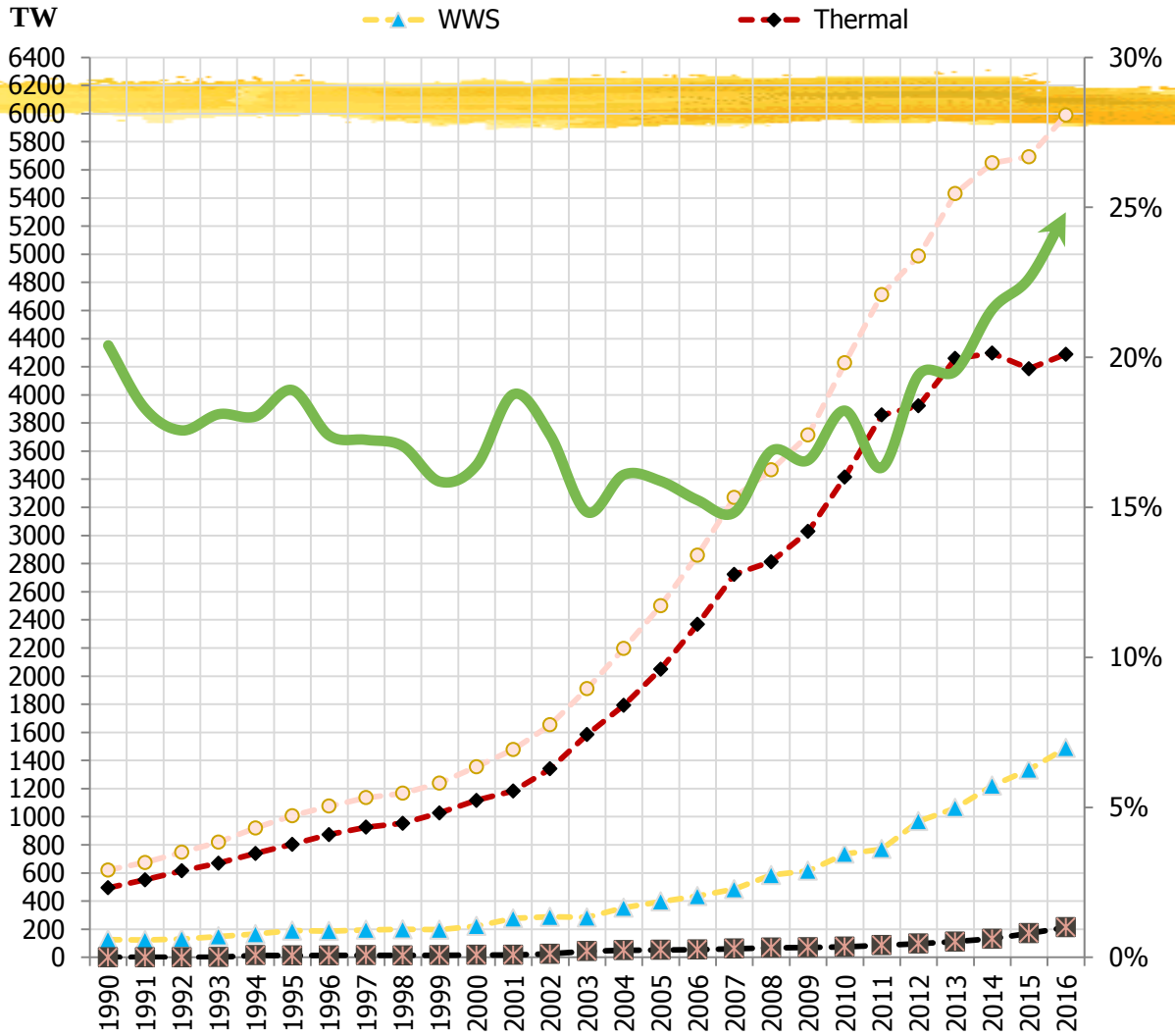
Note: Eligible renewable energy resources include biomass, geothermal, small hydro, solar, and wind etc.

Annual electricity generation in Germany 2002-2016



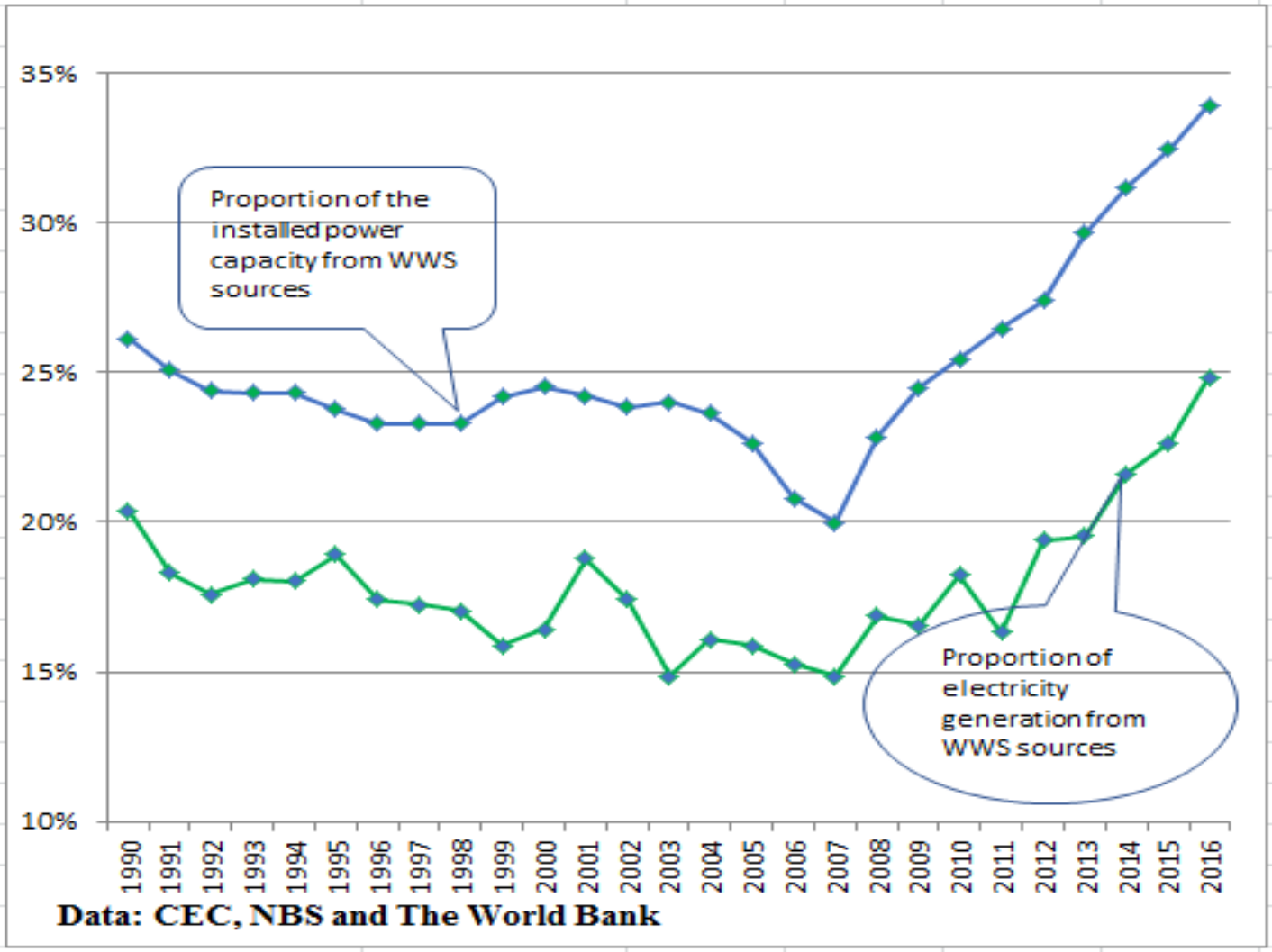
Data: Fraunhofer ISE

Annual electricity generation in China 1990 - 2016

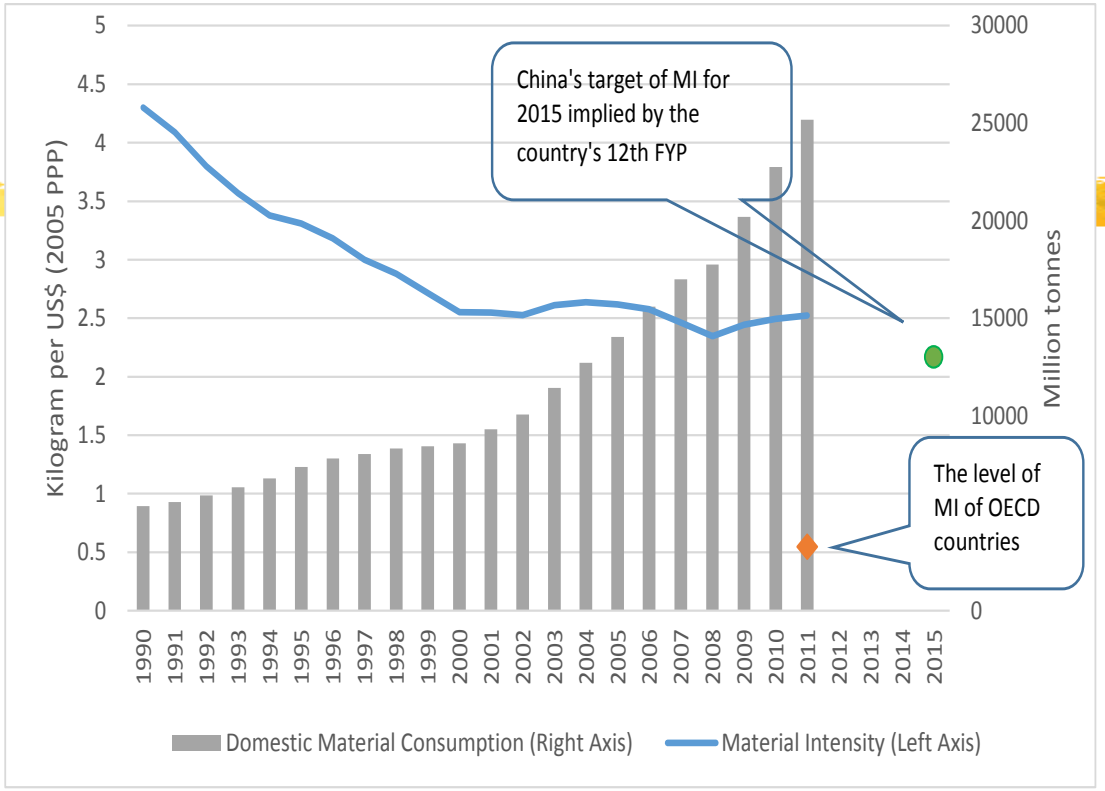


Data: CEC, NBS and World Bank

China green energy shift, by capacity and by electric generation



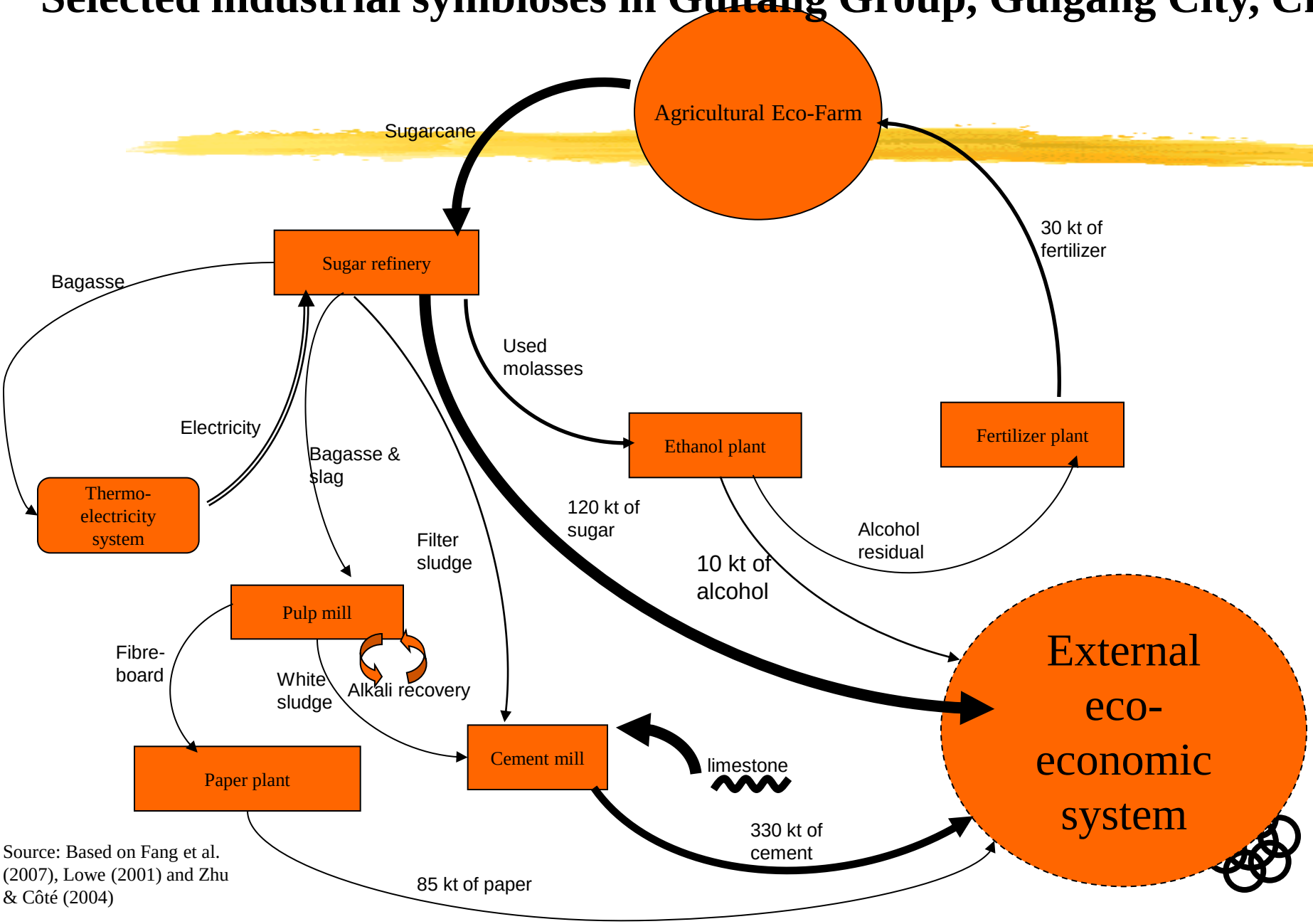
China's material intensity still well above (worse than) OECD



China's share of global resources usage is growing – and its waste disposal problem

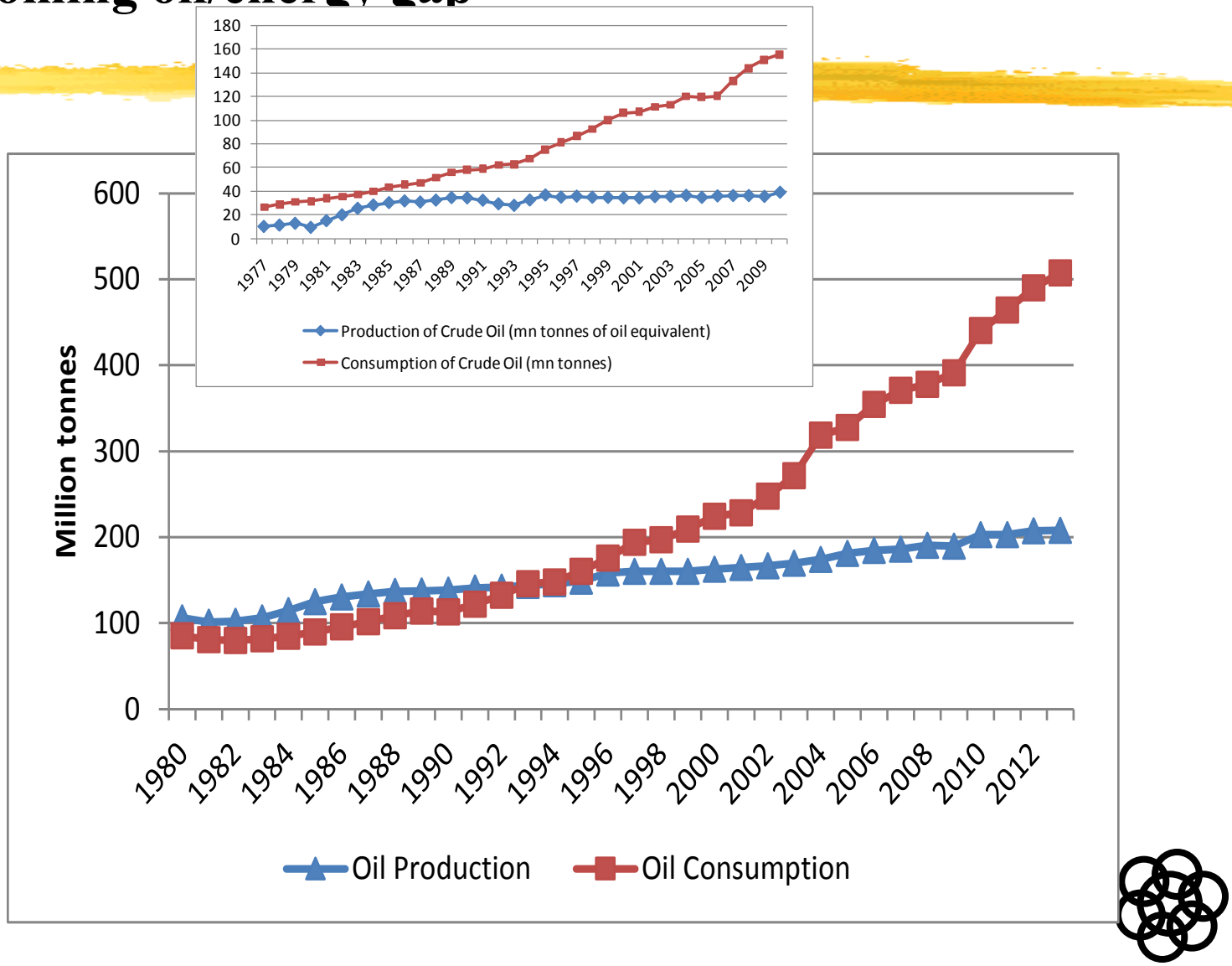
New dramatic solutions called for → Circular Economy

Selected industrial symbioses in Guitang Group, Guigang City, Chin



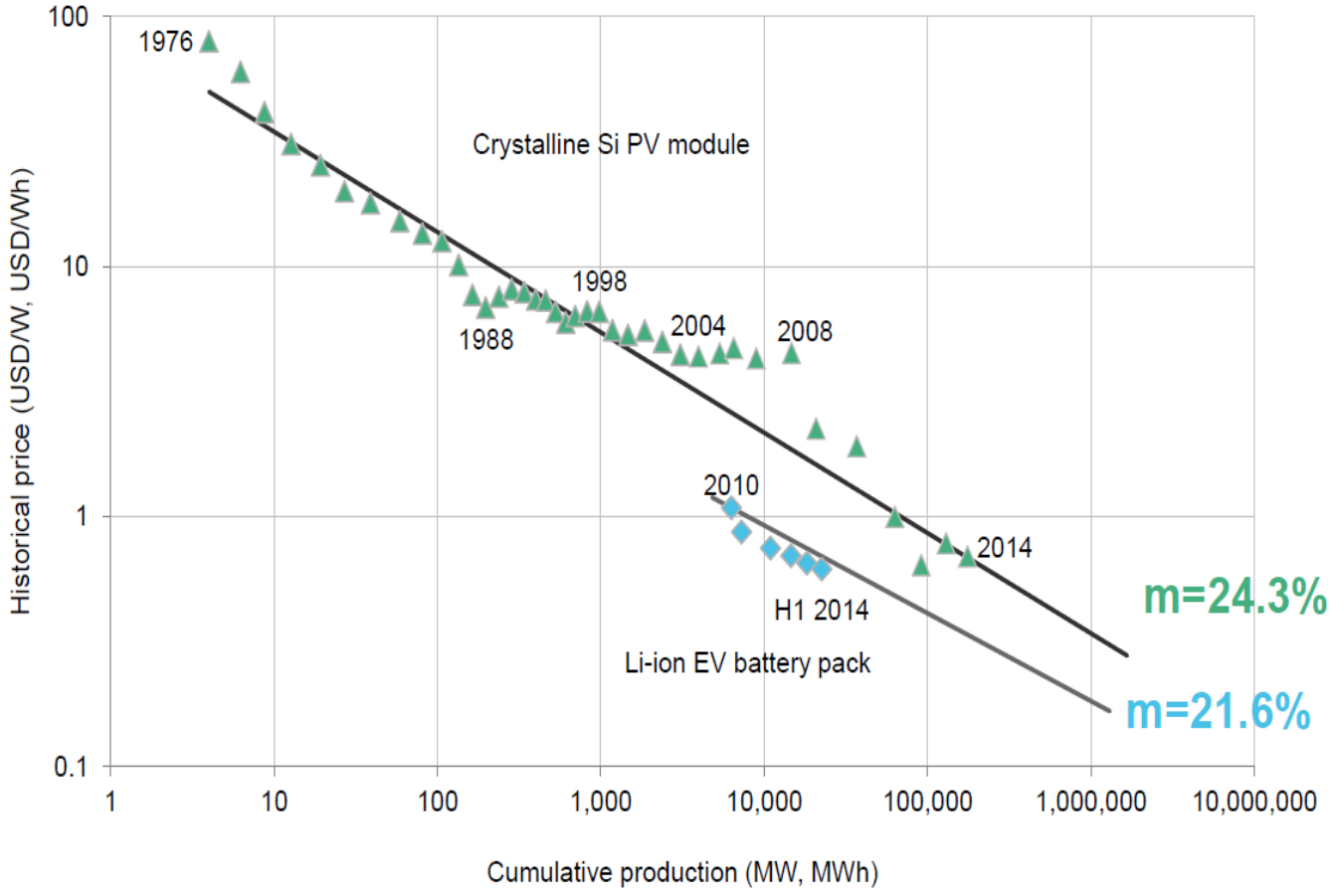
Source: Based on Fang et al. (2007), Lowe (2001) and Zhu & Côté (2004)

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



How world became dependent on the automobile – and oil

Reducing costs -- Solar PV and Li-ion battery storage Learning curve (BNEF)



Solar PV: Market expansion drives down costs

Expansion of the global market for solar PV cells, largely supplied from China, → driving down costs by 80% since 2008

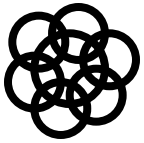
A universal process: **as market expands, costs come down**

Nothing new here. The same principle of industrial expansion coupled with cost reduction established US supremacy in the automotive industry a century ago.

Between 1909 and 1916, Henry Ford reduced the cost of his Model T Ford from $950 to $360, a 266% drop over seven years. Each year, sales doubled – from just below 6,000 in 1908 to over 800,000 in 1917.

Same process is underway with solar PV cells – manufactured devices.

Market expansion -> manufacturing efficiencies (division of labor) -> co reduction -> further market expansion -> further efficiencies -> further cost reductions

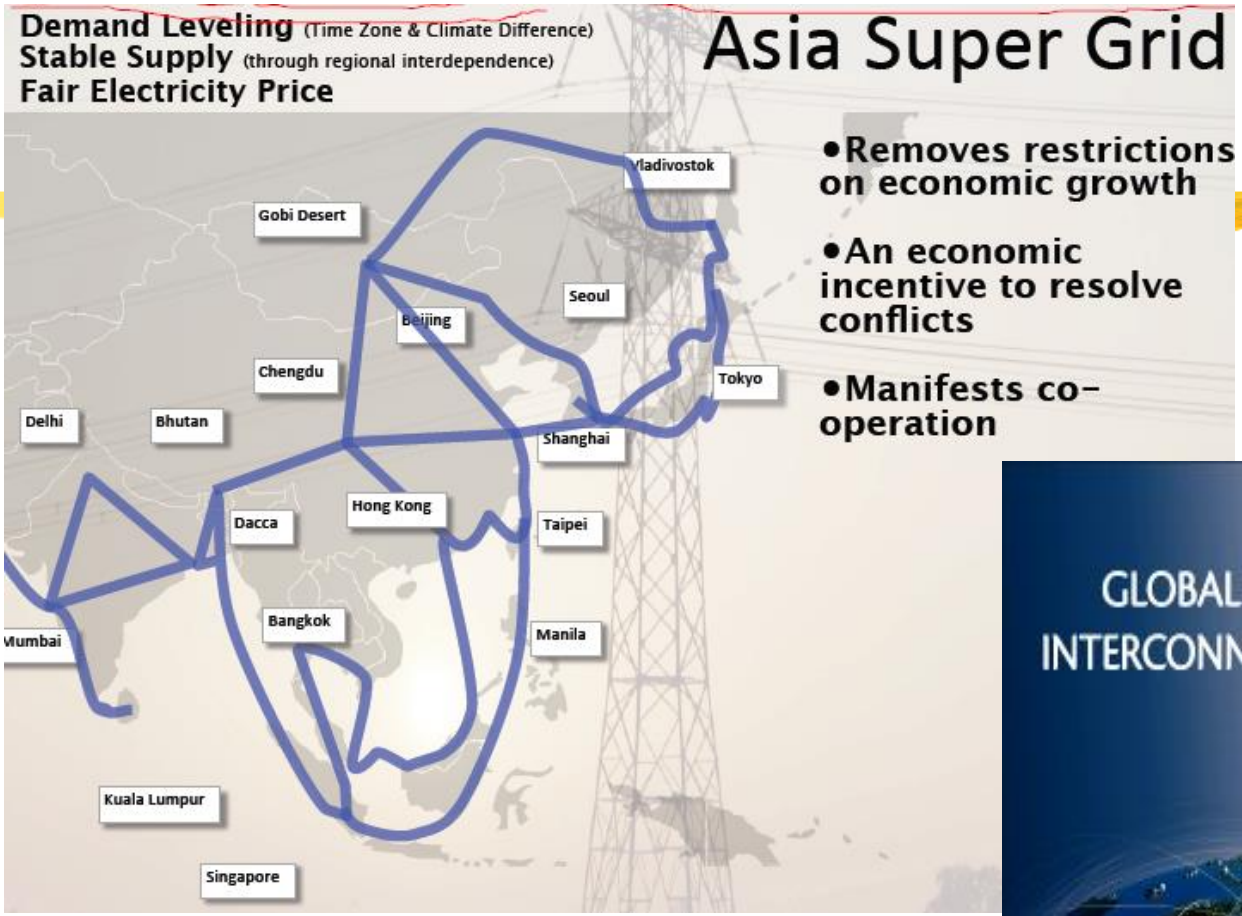


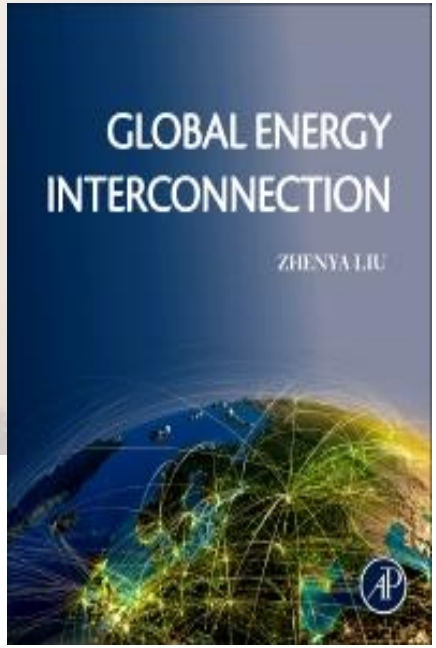
A chain reaction: Circular and cumulative causation

China's High-Speed Rail plans to 2020: North-south and East-west corridors

Source: Ministry of Railways, China

Asian Supergrid: Proposal from JREF





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
These new business deals are possible only because China has driven down the costs of renewables

So – three criteria for technoeconomic paradigm shift are satisfied

CSP Concentrated solar power
Morocco a new player

- Developing countries now leapfrogging to advanced tech
- **Morocco** Noor 1 project (Ouarzazate)
- First phase 160 MW of 500 MW (0.5 GW) project online Dec 2015
- World record low tariff of 18 US cents per kWh
- Energy storage with molten salts
- Part of Big Push 2 GW solar 2 GW wind 2 GW hydro by 2020
- Public-private consortium created, with ACWA Power (Saudi Arabia)

A smart developing country strategy

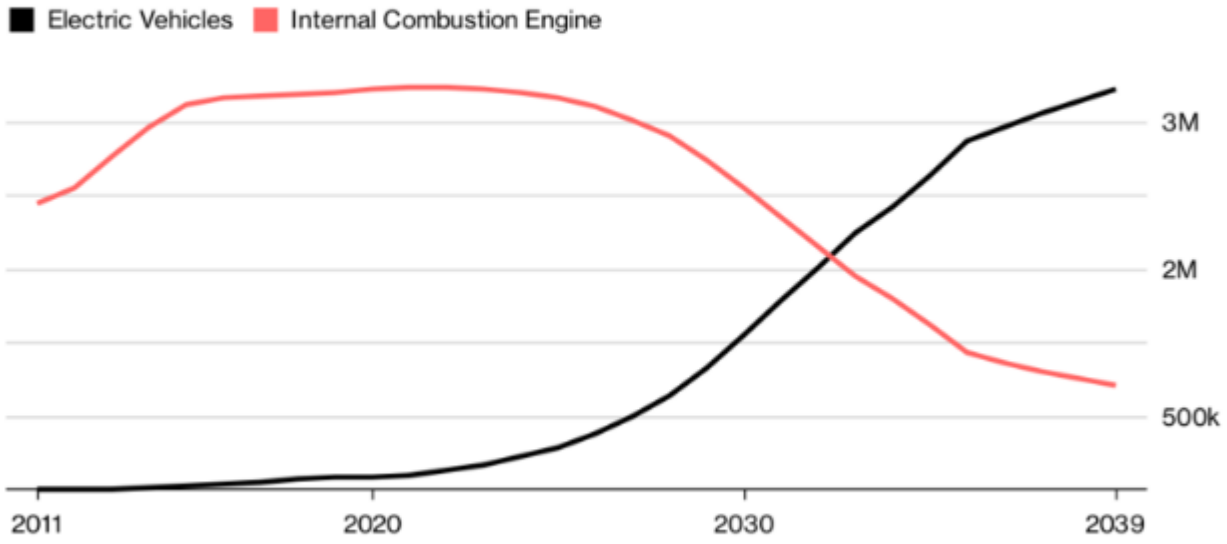
Sixth wave transition in food and water production
Sundrop Farms

Sundrop Farms is bringing ‘closed environment agriculture’ to next level – a way of introducing manufacturing techniques to mass production of food (e.g. tomatoes)

Can be scaled up to global dimensions – and extended to other veges, fruits, grains, seafood

Electric Will Overtake Gasoline and Diesel

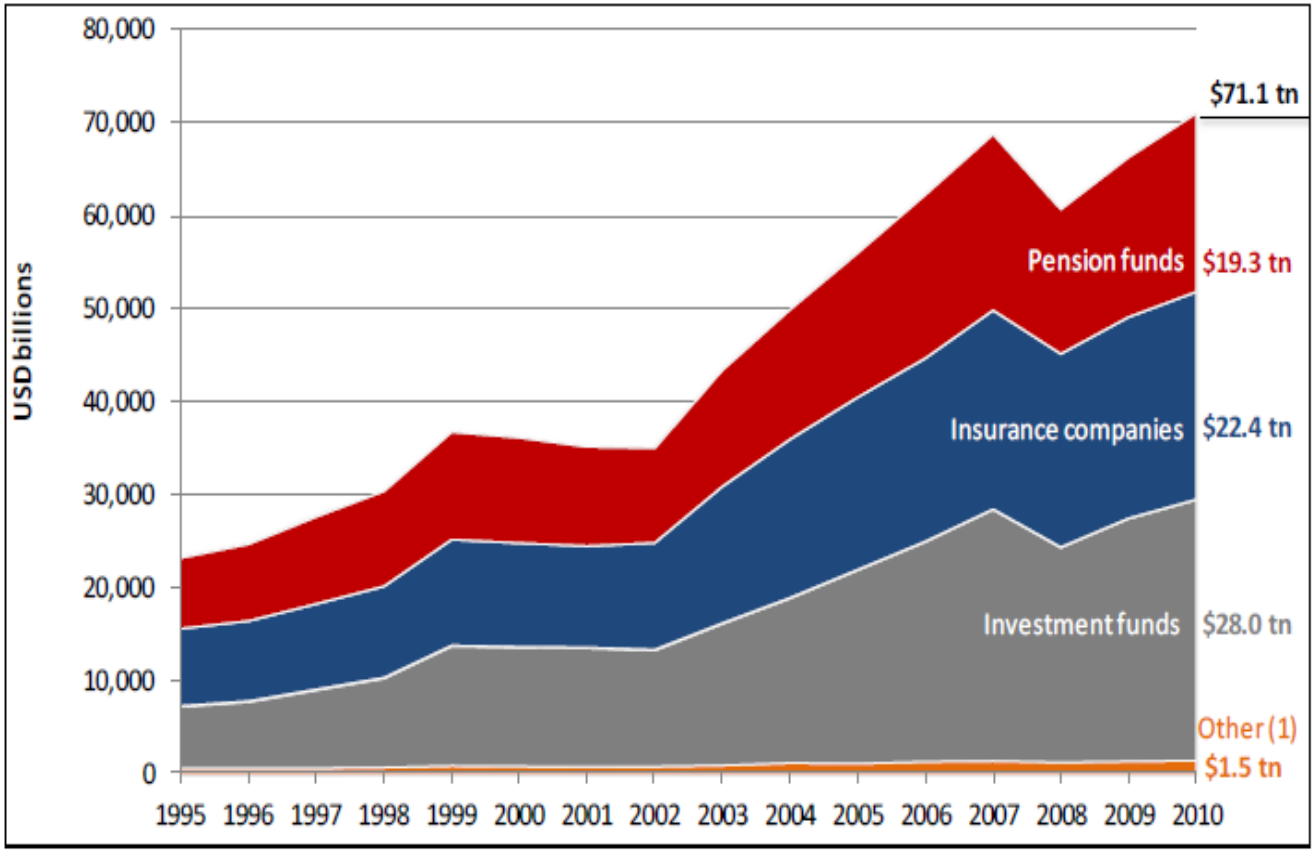
By 2040 almost 80% of new car sales in the U.K. will be electric



Source: Bloomberg New Energy Finance

Bloomberg

Funds available for investment (Institutional investors)



Source: OECD Global Pensions Statistics and Institutional Investors databases and OECD estimates[15]

Source: Andersen (2002) Fig. 1, based on Mitchell, B.R. (1988) *British Historical Statistics*. Cambridge: Cambridge University Press, p. 541. [Data for Ireland are not included. The data for 1868–70 are lacking or are problematic.]

2013: Kexim Green Bond issue

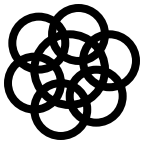
- March 2013 Korean Export Import Bank
- Floats $500 million 5-year bond designated for climate investments
- Targeted at institutional investors (pension funds, SWFs)
- Oversubscribed
- Funds to be channelled to green projects, audited by 3rd party CICERO (Centre for Int Climate and Env Research, Oslo)
- 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
- Follow-up 2015: New $400 m green bond

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

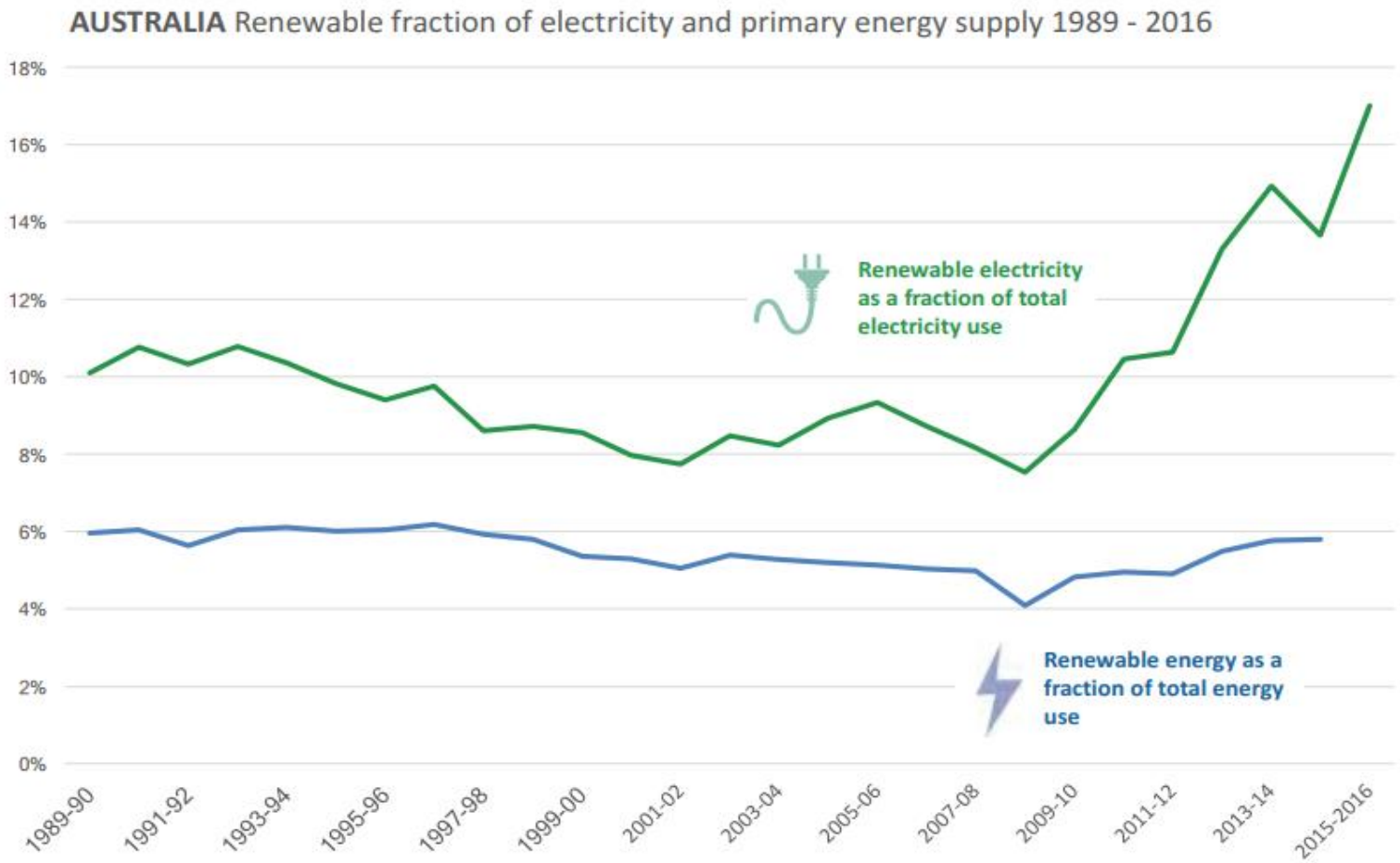
Strong discipline for holding to green investment promises

Greening of finance
2016: Chinese Green Bond issues

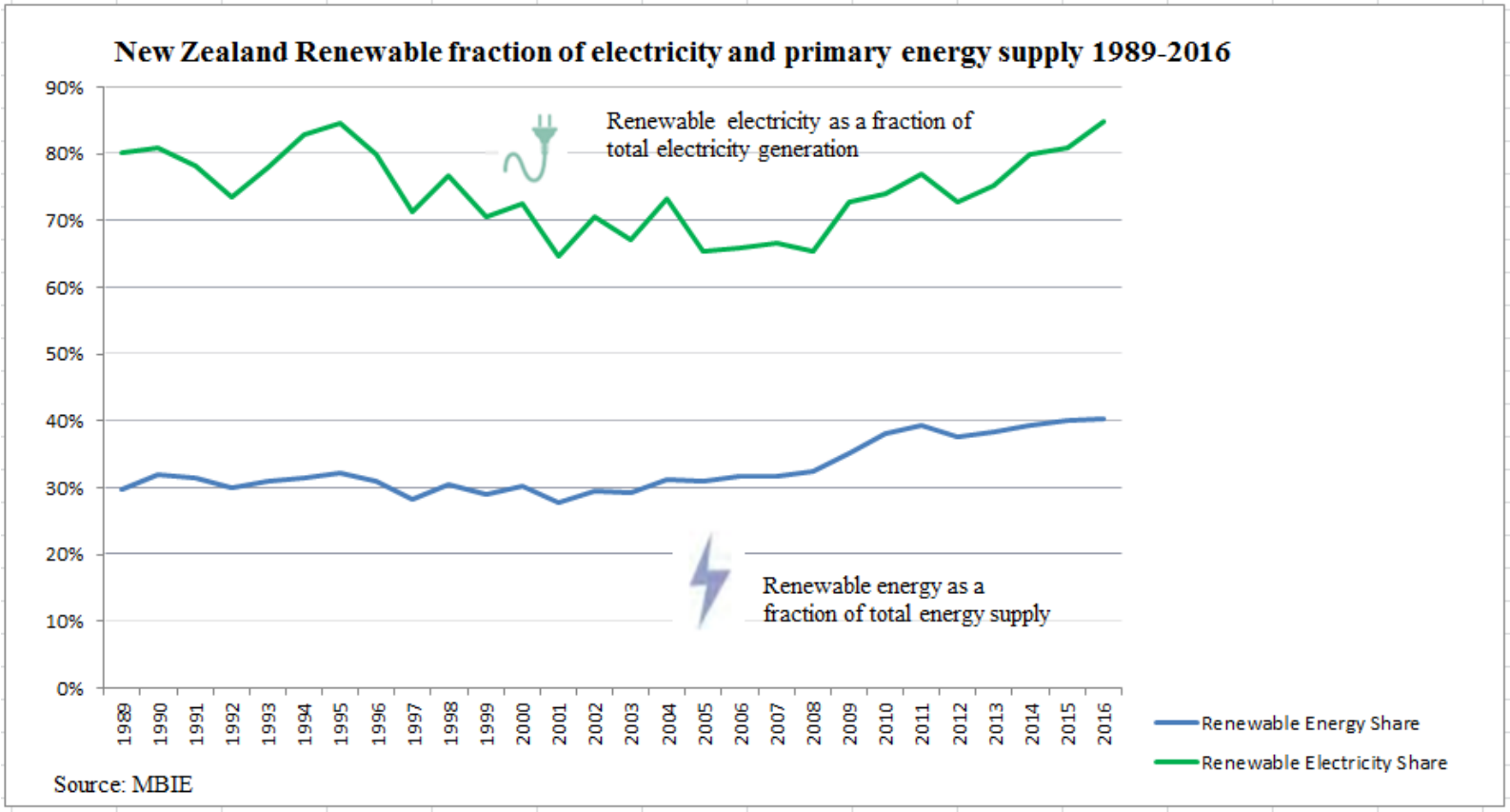
- April 2015 Green Finance Task Force in China issues report 'Establishing China's Green Financial System' (Ma Jun, PBC)
  Investment needed: 2 trillion yuan (US$320 billion) or more than 3% of GDP, for at least the next five years
- Oct 2015 ***Agricultural Bank of China*** floats $1 billion green bond
- Jan 2016 ***Shanghai Pudong Development Bank*** green bond worth 20 billion Yuan (US$4.3 billion) designated for climate investments
- July 2016 ***Bank of China*** issues green bond for $3.03 billion (mix of currencies)
- **$36 billion** in issuance up to end 2016 – cf global total $81 billion
- Targeted at institutional investors (pension funds, SWFs, China domestic investors)



Situation in Australia:
Greening of electric power system

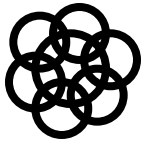


Situation in New Zealand:
A green electric power system mildly greening further



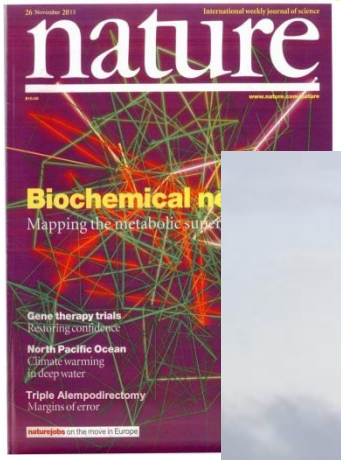
Situation in New Zealand: Further greening of electric power system?

- New Zealand has high proportion of renewable sources of electric power – reaching 80% of electric generation (or 85%?) – based on legacy of hydro and geothermal
- The 15-20% of thermal sources (coal, oil, gas) are not declining fast enough; little evidence of government commitment to raise contribution of non-thermal sources of power, industry, transpo
- Strong support for a shift to zero-emissions target (e.g. Greenpeace, Greens) and Labour has now adopted this target as well
- Green electric power companies – Ecotricity, Meridian, Origin, Contact
- Green finance now emerging, e.g. Contact 'Green Borrowing' prog
- What would NZ have to fear from the global green shift?



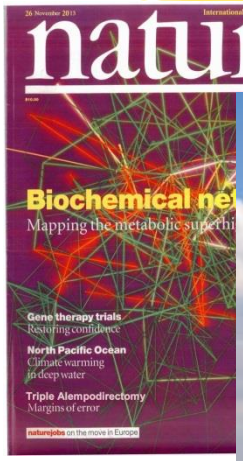
Economics: Manufacture renewables to build energy security

Nature 11 Sep 2014

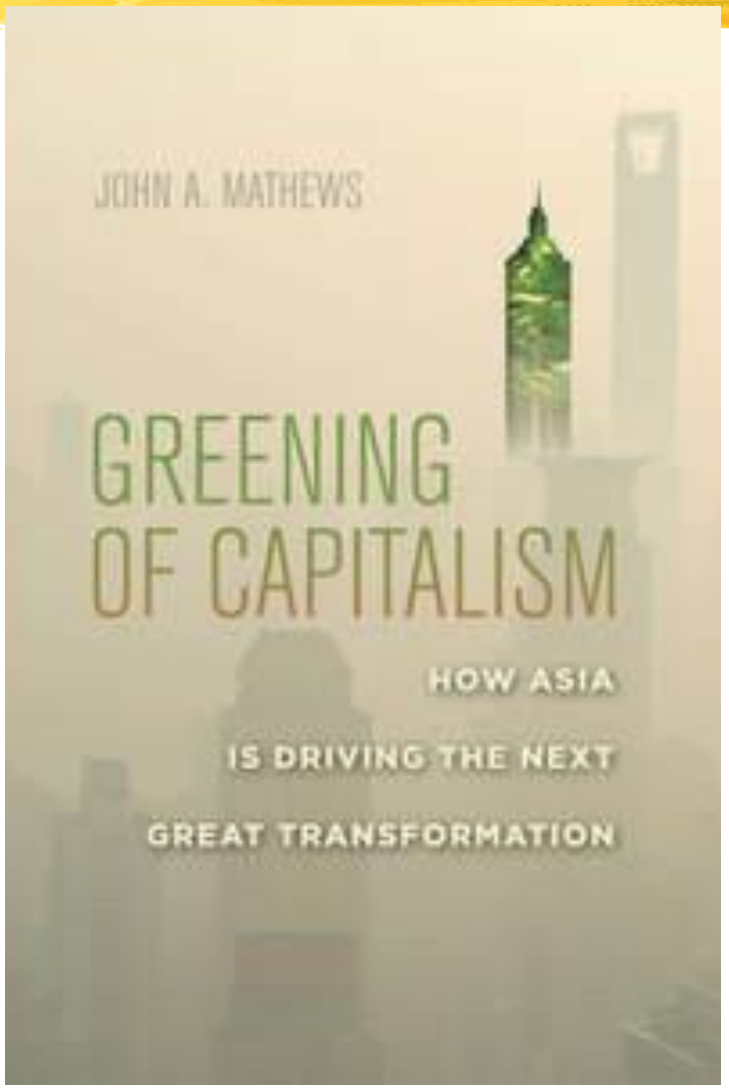


Circular Economy: Lessons from China

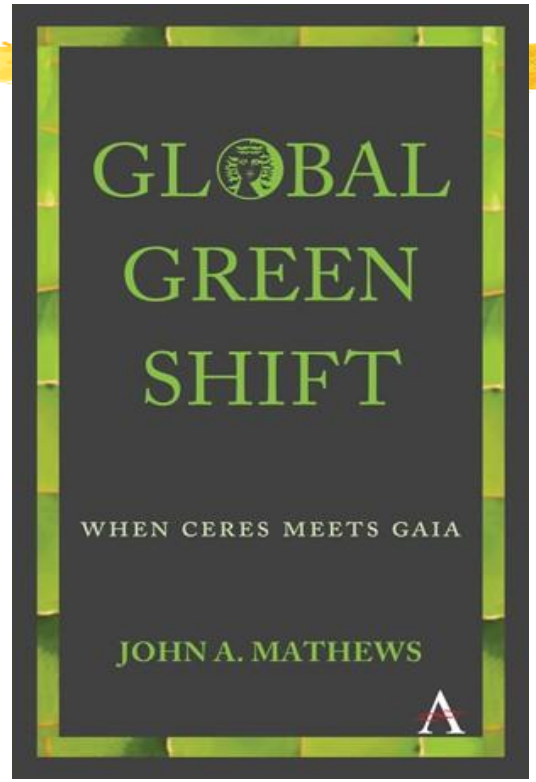
Nature 24 March 2016



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



Global Green Shift: When CERES Meets GAIA



In this sweeping global analysis of environmental challenges, Mathews weds Schumpeterian and renewable energy insights to draw the bold conclusion that China and India have embarked on a course to lead the world toward sustainable solutions. The book documents China's ecomodernization strategy, placing it in the vanguard of clean and renewable power.' –***Mark Selden***, *Professor Emeritus of Sociology, State University of New York at Binghamton, USA, and editor, The Asia-Pacific Journal*