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Greening Development: The Role and Experience of Development Banks

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Abstract

The greening of development is commonly depicted in the West as a moral imperative, as an obligation to clean-up carbon-fuelled industry. But when viewed as an implication of the diffusion of industrialization, spearheaded by China, India and Brazil, it becomes an economic imperative – for the clear reason that the conventional model of industrialization, based on virtually unlimited access to fossil fuels and resource intensity, will not scale to the planetary level now needed. Issues of energy security and resource security loom as large for the industrializing powers of the 21st century as concerns over climate change. Greening is a process, not an end-point – and it is best effected at the point of change, namely at the point of investment, rather than through changes to existing production facilities. The role of finance in the channeling of investment towards greener activities is therefore crucial, and national development banks have proven to be key institutions in this as in prior development challenges. National development banks play an important role as mobilizers of direct financing of investment, as opposed to indirect financing via carbon markets that can promote malignant financialization. New financial instruments such as green bonds are providing the means through which such direct financing may be effected, with a continuing and important role being played by national development banks.

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1. Introduction

The process of industrial development is by now well understood, informed as it is by the experiences of the early industrializers – the Western countries now grown wealthy – and in the second half of the 20th century by Japan and then by the East Asian tigers – Korea, Taiwan, Singapore and Hong Kong. This set of experiences has been captured in a toolbox of strategies and institutions well known to heterodox political economists, if denied by adherents of the neoliberal economic orthodoxy and the proponents of the Washington Consensus. Now the drama has shifted in the 21st century to the emerging industrial giants, China, India and Brazil (who together might be called the BICs – BRICs without Russia), who are capturing the same potential latecomer advantages as their predecessors, and deploying the same broad model of state-led developmentalism, with a special role played by finance and national development banks.

While all the wealthy countries today, and their East Asian emulators, were able to deploy a model of industrialization based on access to fossil fuels, extensive resource throughputs and sophisticated finance, that option is becoming less and less available to the emerging industrial giants of the 21st century as they grapple with a new set of challenges. Now under pressure from the peaking of resources and fossil fuels, and growing geopolitical tensions, the BICs are perforce having to develop an alternative “green” model of industrialization to complement and eventually supersede, the “black” model that has powered all previous industrializers. The issue is: can the emerging industrial giants frame their strategies in such a way that these pressures can be accommodated, through patterns of sustainable green growth?

In this paper I propose a novel argument as to how these goals might be met, involving sophisticated finance effected through national development banks. Manufacturing has always been the core element of industrialization – because it provides the means to raise productivity, raise incomes, and allow for the restructuring of industry away from low value-added to higher value-added activities. Now there is an additional argument for manufacturing; it provides the means of producing energy devices that enhance energy security, through falling costs and ubiquity – as opposed to rising costs and geopolitical tensions (not to mention pollution at local and global levels) associated with continuing resort to fossil fuels.

Likewise there has always been a powerful argument for national development banks, as the vehicles that could mobilize finance for a Gerschenkronian catch-up effort, attracting investment funds and catalyzing further inputs from the private sector. Now as the challenges of greening make their presence felt, the role of development banks is shifting again, as they take the lead in mobilizing direct finance for investment in new green sectors that mitigate energy and resource insecurities. They are fashioning new instruments for the purpose such as green bonds and long-term credit arrangements that enable Chinese, Indian and Brazilian firms to compete with their established rivals.

The greening of development, in light of this argument, is a necessary and unavoidable challenge for these emerging industrial giants, and the greening of finance is the necessary counterpart for their development banks. The paper elaborates on this argument, making the case for the changes needed and advancing evidence that the necessary changes are already under way.

2. Diffusion of industrialization and its planetary limits

The world's wealthy and advanced countries are all industrialized, and they all industrialized through a common pattern – namely use of fossil fuels, access to almost unlimited resources, and credit made available through a sophisticated banking and finance system. In the 21st century there is now underway a vast expansion of the industrialized world, from the approx. 1 billion people of the West and North to the billions of people in the East and South who aspire to enjoy the fruits of industrialization. This expansion, or diffusion of industrialization to the rest of the world, was concentrated last century in East Asia, and is now diffusing to encompass the emerging giants China, India and Brazil, to be followed by the other major countries of the presently developing world.

The OECD has captured this fundamental phenomenon in what it calls “shifting wealth” – as depicted clearly in Fig. 1. Here the top line indicates the falling proportion of world manufacturing value-added by the OECD countries, and the rising lower line the manufacturing value-added of the non-OECD countries – for which, read China, India and Brazil (OECD 2012). The two lines will clearly cross over before the year 2020 – by which time it will be correct to talk of a sinocentric world, at least in terms of manufacturing, trade and industrial production. Some Brazilian economists correctly foresaw this state of affairs (Castro 2008).

Fig. 1 about here

These trends indicate a shift in two senses – both in terms of the rise of the “East” effected through its own industrial development, exploiting its latecomer advantages and leapfrogging to the lead in certain sectors (such as in high speed rail and renewables, for China, or in sustainable biofuels, for Brazil), and in terms of the decline of the “West” through outsourcing, off-shoring and other practices exacerbated by a malignant form of financialization. Both trends working together make for a dramatic shift, or what the *Financial Times* terms the “Great Convergence” (superseding the “Great Divergence” of the 19th and early 20th centuries).¹ A globalized world production system, with new logistics hubs (e.g. Dubai in the Gulf; Chengdu in Western China linking by rail to Central Asia and Europe), new global value chains and the rise of new clusters of industrial activity in China, India and Brazil, represents a 21st century phenomenon -- the dominant trend in our era.

All would be well if this phenomenon of shifting wealth could extend “business as usual” indefinitely. But this is not possible. Even if the planet allowed such expansion in fossil fuel usage and resource spoliation to continue indefinitely, the geopolitical pressures arising from tightening pressure on peaking oil, coal and gas supplies, and on commodity supplies more generally, would rule out continued BAU expansion. But the fact is that the “Western” model of industrialization cannot scale to accommodate the rising industrial powers of the 21st century.² This is a profoundly inconvenient truth.

Consider just the issue of rising dependence of China and India on oil imports. The increasing gap between domestic production and consumption (bridged by imports) is clear to see, as in Fig. 2. In the case of China, consumption is now in excess of 500 million tonnes of oil equivalent (mtoe) while production lags behind, making for a yawning gap of more than 200

¹ See “In the grip of a great convergence” by Martin Wolf, *Financial Times*, 4 Jan 2011, available at: <http://www.ft.com/intl/cms/s/0/072c87e6-1841-11e0-88c9-00144feab49a.html#axzz37dYAJ8q6>

² See Spence (2011) for an argument that the Asian powers are moving towards a new development model; while Hu Angang (2006; 2011) provides a much more explicit argument.

mtoe that must be made up from imports. India likewise has an even more serious gap, if less in absolute terms (more than 120 mtoe).

Figure 2 here

Bodies like the OECD and IEA envisage that almost all the growth in oil imports will come from these enormous industrial powers – China, India et al. The 2009 report from the IEA pictures China and India as dominating growth in consumption, depicted in Fig. 3. By contrast the OECD countries themselves have already reached the peak of oil consumption.

Figure 3 here

Figs 2 and 3 are not just statistical charts – they portend extreme conflict over the remaining recoverable oil resources, as demand from China and India rises (in the absence of alternative energy sources) while supplies fall -- available sources will become increasingly difficult, expensive and dangerous and will be sourced from geopolitically unstable regions.³ Not to put too fine a point on it, these charts spell a future of war, revolution and terror – in the absence of any alternative. This is why an alternative model of industrialization, one that is less dependent on fossil fuels and resources stripped from the earth (as opposed to being recirculated), simply has to be found.

The good news is that an alternative model *is* being found – and it is being invented in the BICs (Brazil, India, China). Take the case of China. While its “black” model of an energy system growing rapidly is well known (Fig. 4(a)), where new coal-burning power stations are being added every year, this is increasingly being complemented by a “green” energy system based on renewables. Fig. 4 (b) depicts the rapid increases in wind power in China, based on a growing domestic wind turbine manufacturing industry – doubling every year, and reaching the position of largest such industry in the world by 2012.

Figs 4 (a; b) here

India is now going through the same kind of coal-fired “black” energy revolution that China has been experiencing for the past decade and a half – except that India is even more vulnerable, and Indian businesses are subject to repeated blackouts and brownouts from the inadequacy of fuel supplies. In an article in the *NYT* (April 2012) the effects of these brownouts were described, resulting in significant loss of economic output.⁴ Commentators attribute a reduction in growth from 10% to 7% to this factor – and so India has everything to gain from shifting to a green strategy based on renewables.

Brazil is a different kind of emergent energy power, with an installed base of hydroelectric power and an advanced biofuels (bioethanol and biodiesel) industry that operates at the world frontier for efficiency and technology. Wind power is the fastest growing renewable energy source in Brazil, with a further 4.7 GW added in 2013, through the country’s unique auction system. Wind power is especially suitable for Brazil because it boasts some of the windiest

³ Michael Klare has been a clear voice drawing attention to these risks of continued fossil fuel dependence; see Klare (2012) for a recent statement of the problem.

⁴ See “India struggles to deliver enough power” by Vikas Bajaj, *New York Times*, 19 April 2012, available at: http://www.nytimes.com/2012/04/20/business/global/india-struggles-to-deliver-enough-electricity-for-growth.html?pagewanted=all&_r=0

places on the planet. Brazil's installed hydro capacity is 60 GW – small by Chinese standards, but nevertheless accounting for 83% of Brazilian power production – making the country largely immune from oil and fossil fuel issues. (Brazil has hardly any coal while it is rich in iron ore – inducing some steel companies to utilize biochar in production as well as imported coke.) Brazil is co-owner with Paraguay of the Itaipu hydroelectric plant on the Parana River, the world's second largest hydro plant, rated at 20 GW.

The scale of investment in a renewable energy system by China, India et al is striking, where the trends up to 2013 are depicted in Fig. 5. It is now clear that China in particular is making enormous investments in a “green” energy system that complements its “black” coal-fired system – with momentous consequences for the rest of the developing world, as the costs of renewables relative to fossil fuels are driven down, making them accessible to all.

Fig. 5 about here

These changes in the energy system, raising the profile of the green sector while comparatively reducing the role played by the black, fossil-fuelled sector, are complemented by changes in the resources and commodity sector. Again China is leading the way in implementing a new model of the Circular Economy, through which resources are recirculated via outputs from one industrial process being converted into inputs for another. While this approach was pioneered in Europe (e.g. Kalundborg in Denmark) and has been raised to a legislative requirement for recycling in both Germany and Japan, it is in China that the Circular Economy has been made a central national developmental strategic goal. India and Brazil are following – such as in Brazil's efforts to capture sugar mill wastes and convert them into raw materials for power production and for associated activities such as paper making.⁵

Together these changes in the physical underpinnings of industrial development provide a means of resolving the severe energy security and resource security problems that the emerging industrial giants have to face. By confronting these novel challenges and devising these novel solutions, they are inventing a new mode of green development – and new modes of financing to go with it.

3. Greening as an economic imperative: energy and resource security; declining costs

It is no surprise that it should be the leading developing countries (the BICs – Brazil, India, China) that are greening their industrial systems, since it is these countries that have most incentive to do so (they bear the costs of pollution) and they can craft strategies of leapfrogging to utilize the most recent clean technologies. They do not have major established infrastructure to move beyond, unlike their counterparts in the developed world – they do not have the same degree of “carbon lock-in”.⁶

While greening of economies might be seen as a moral imperative in the West, it is actually an economic imperative in Brazil, India and China. Greening of energy and resource systems is needed to avoid the potential geopolitical conflicts with continuing along a Business as usual pathway, as well as to avoid the insecurities associated with blackouts and brownouts that result from fossil fuel insufficiencies.

⁵ With my colleague Dr Hao Tan I have discussed these trends in Mathews and Tan (2011).

⁶ On the greening of development, see for example Carraro and Massetti (2011).

Thus energy security looms large for the BICs – and yet the issue is still discussed largely within a framework of securing access to fossil fuels and managing their prices.⁷ By contrast, renewables offer themselves as an important contributor to the solution, or reduction of energy insecurity. This is so for the very important reason that all renewables devices (wind turbines, solar PV cells, lenses and mirrors) are the products of manufacturing. They are not extracted from the earth like fossil fuels and virgin resources (iron ore etc.). As manufactured items, they can be produced anywhere, without the restrictions imposed by geography on fuel and resource extraction. More to the point, as manufactured items they benefit from the universal feature of manufacturing, which is the potential for the generation of increasing returns.

As I have argued with Erik Reinert, this feature that views renewables as a major source of energy security, insofar as they are manufactured (and hence potentially producible anywhere within reach of manufacturing infrastructure) and subject to generation of increasing returns (as opposed to diminishing returns associated with extractive industries), is a prime rationale for the greening development strategies.⁸

The biggest issue from such a perspective is cost. Are renewables coming within the same region as conventional fossil fuels for the production of power, and beyond that for production of other industrial materials such as heat and water? The evidence indicates that China's major investments in raising the scale of its renewables manufacturing has driven down costs – in just the way predicted by economic analysis of mass production.

As the scale of production increases, so unit costs decline. In a global industry such as solar PV, the scale of market increase has been dramatic – as have the cost reductions, leading to price reductions and further expansion of the market. In fact solar PV costs have declined by 80% over the past five years – as demonstrated in Fig. 6.

Figure 6 about here

The top curve in this Chart indicates how costs have been reducing each year as the scale of production increases (horizontal axis). This is known as the learning, or experience curve. It is found throughout mass production industry, and is the essential element that drives industrial transformation. The bottom curve shows second generation PV producers' costs, which by standard reasoning would undercut the costs of first generation producers, paving the way for new, advanced firms to take the lead. But instead what has happened is that as the global market has expanded Chinese first-generation solar PV producers have continued to bring their costs down, even below those of second-generation producers, forcing them out of the market (and causing some high-profile bankruptcies in the US such as Solyndra). US claims that these cost reductions and the consequent low prices were instances of unfair competition were taken to the WTO and dismissed in July 2014.⁹

China's discovery of the power of market expansion and investment in driving down costs, and so enhancing its energy security, is not without precedent. Just over 100 years ago Henry

⁷ See Ma (2013) for a recent contribution.

⁸ See our recent paper published in the journal *Futures* (Mathews and Reinert 2014). Reinert is best known for his insightful and heterodox approach to development, exemplified in his book *How Rich Countries Got Rich ... and Poor Countries Stay Poor* (2007).

⁹ See "WTO rules against U.S. import tariffs on China steel, solar panels", Reuters, 14 July 2014, available at: <http://www.investing.com/news/economy-news/wto-rules-against-u.s.-import-tariffs-on-china-steel,-solar-panels-294720>

Ford made a similar discovery. Between 1909 and 1916, Henry Ford reduced costs of his Model T Ford from \$950 to \$360, a 266% drop over seven years. Aggregate sales leaped ahead, from just under 6,000 in 1908 to just over 19,000 in 1910, to 40,000 in 1911; to 80,000 in 1912 – and so on, doubling each year, until sales reached over 800,000 in 1917, the year when the US entered the First World War. This story of unparalleled industrial expansion established US supremacy in the newly emerged automotive industry – and drove home the argument that nothing can stand in the way of cost reduction and market expansion.

Fast forward a century to the case of renewable energy, where Chinese efforts to create a new global solar PV industry are being driven by unprecedented price drops based on cost reductions, which in turn are based on global market expansion. This is a process known in economics as circular and cumulative causation.

Many developing countries are now starting to use the language of energy and resource security in building their renewable energy systems. Take the case of Malaysia, and in particular its Sarawak Corridor of Renewable Energy (SCORE) project, which involves construction of 20GW of hydroelectric power along a 320-km riverine corridor, and calling for investment of US\$105 billion by 2030. SCORE is viewed by Malaysia's planners as a developmental project of the highest priority, an important component of both the 9th and 10th Malaysia Plan (respectively covering the years 2006-2010 and 2011-2015).¹⁰ One of the key drivers of the SCORE development is energy security, namely to get Sarawak off its current near 100% dependence on fossil fuels (gas and oil) and move instead to a portfolio of energy sources, with hydropower anticipated to rise from a 10% share in 2006 to 71% share by 2030.

Economists hold the floor in discussion of policies to mitigate climate change, emphasizing the costs and of such policies (e.g. in terms of % of GDP) and the timing.¹¹ By contrast, the more pragmatic business sectors in advanced countries like Germany and Japan have already recognized that green energy and clean technology industries in particular represents the biggest business opportunity of the 21st century, and are moving rapidly to establish strong positions in these sectors.

Germany announced in June 2011 a radical about-turn in dropping its previous reliance on nuclear (which had been retarding the renewables option for decades, as deplored by scholar-activists like Scheer) – triggered by the Japanese Fukushima disaster. This was then followed up with successive announcements on its planned build-up in renewables industries – in what the Germans call the *Energiewende* (“energy transition” or transformation. Germany has moved on from its heavy promotion of renewables markets, via its feed-in tariff system embodied in the Renewable Energy Sources Law of 2000 and earlier incarnations, to the far more significant promotion of renewable energy industries themselves – exactly as is being done by China.¹² Although for various reasons more problematic, Japan also has the makings to pursue a similar course. Japan has a track record of building a circular economy and providing strong backing for renewables earlier in the 1970s and 1980s until lower oil prices discouraged such initiatives. So before too long Germany and China and perhaps Japan and Korea are likely to emerge as serious proponents of the greening of industries, both for

¹⁰ A specific development agency has been created for SCORE: the Regional Corridor Development Authority (RECODA), which is vested with responsibility for attracting and coordinating the investment. For discussion, see Sovacool and Bulan (2013). For the latest developments, see the project's website at:

<http://www.recoda.com.my/>

¹¹ See e.g. Garnaut (2008); Stern (2007); Nordhaus (2008). The World Bank has added its perspective in its *Inclusive Green Growth* report (World Bank 2012).

¹² See Davidson (2012) for a striking account of the German *Energiewende*; it promises to provide a lead for the rest of the world in how to build renewable energy industries, comparable to that already instigated by China.

domestic consumption and export. Between them, these industrial powers would represent an unstoppable force turning the global industrial machine from its present addiction to fossil fuels into something quite different – and creating the platform for the greening of development by China, India and Brazil.

China and the countries putting their efforts into renewables like wind power and solar PV are all making a good bet. Renewable energies contribute directly to promotion of energy security (or rather reduction of insecurity) even when evaluated in terms devised to discuss security in terms of fossil fuel supplies. Accordingly, renewables may be considered fundamentally as a source of energy security – in that they are associated with manufacturing activities that generate increasing returns and declining costs. As recognized over centuries, manufacturing activities are superior in terms of wealth generation to agricultural and extractive activities because they embody increasing returns, as opposed to diminishing returns for activities that are dependent on land as a resource.

By contrast with the fossil fuel focus of energy security, and its emphasis on diversity of fossil fuel supplies and their economic feasibility, the emphasis in energy security through manufacturing is on ensuring the viability of manufacturing value chains and the prosperity of manufacturing firms, where competition will ensure that prices are reasonably predictable. This is a perspective that focuses on the real advantages of renewables, as manufactured products. The processes of creating manufacturing value chains will build on each other, creating multiple interconnections and increasing returns as they do so. This may be described as a chain reaction of value creation that can benefit all countries that have some level of renewable energy resources. The contrast with the prospect of diminishing returns from extractive activities is striking.

This perspective on **energy security through the manufacture of renewable energy devices** (rather than succumbing to the insecurity associated with extractive activities) indicates why a greening economy can produce economic growth while not increasing its ‘carbon footprint’. If growth in its conventional sense is viewed as increase in resource throughput (measured as in GDP) then planetary boundaries clearly place a limit on growth. But if growth is considered in the Kaldorian sense of growth in incomes through successive rounds of specialization, each one expanding the market, and the whole growing through circular and cumulative causation, then growth can be seen to occur against a constant resource baseline.¹³ As more and more resources are circulated (recycled) and industrial ecological connections are made, as in China’s pursuit of a ‘circular economy’ (outputs of one process feeding into another process as inputs) so the tempo of economic activities can increase but in a way that is decoupled from increases in resources throughput.

4. Investment and direct finance: the role of national development banks

It is at the point of investment that the transformation of a complex system like manufacturing is best undertaken – and that raises the issue of finance and of investment banks. For this reason, development banks have been utilized in prior episodes of industrialization – to great effect. Now their role in mobilizing and catalysing private

¹³ See Kaldor (1970) for a clear exposition of how an industrial economy grows through successive rounds of specialization and market expansion, via the process of circular and cumulative causation.

investment will prove to be equally efficacious in the next, greening phase of industrial development.¹⁴

While government guidance is essential, the finance required to invest in the new green economy is going to have to come from the private sector rather than from tax-based public finance. The OECD estimates that the scale of investment required in renewables in the decade 2010 to 2020 to be around \$6.3 trillion (i.e. well beyond anything envisaged through public funds), while the size of the potential investment pool is estimated at \$71.1 trillion in 2010, and growing rapidly, drawing from investment funds, insurance companies and pension funds (Fig. 7). Sustained attention is now being given by the OECD to the barriers standing in the way of the deployment of such funds at scale in accelerating the uptake of renewable energies around the world.

Fig. 7 about here

Bonds are the core of the capitalist system. It takes countries decades, if not centuries, to build effective bond markets. They enable governments and leading corporates to raise funds, on the strength of their credibility and reputation. They are ‘investment-grade’ securities, meaning that they are only offered for large amounts – and so their value for green finance is that they can aggregate across a large number of small projects. Diseconomies of scale associated with small projects are decisively overcome by a green bond.¹⁵

Financing of cleantech projects via green bonds make for cheap capital, since the interest charges will always be lower than for conventional bank finance. This means that renewables and energy efficiency projects that might have been put out of the running because of high cost of capital suddenly become viable. The diffusion of green energy and resource projects is therefore accelerated. An example is the \$500 million Kexim bond, issued on international markets in March 2013 by the Korean Exim Bank, and oversubscribed by institutional investors. The proceeds raised are to be channelled towards green investment projects, verified as such by a responsible third party. This can be described as the first real national climate bond – setting an important precedent, and revealing Korea’s green growth strategies in a positive light.

Bonds are serious financial instruments that are not to be played with. If a country’s bonds lose their value, then the country faces ruin. (Technically, it would be unable to meet its payments, and would have to default – a desperate step.) Hence a green bond issued with a national government’s imprimatur (as is the case with the new bond issued by the Korean Export-Import Bank) means that the bond will hold its value only if the projects really are an investment in a green future, and really do have the backing of the government. The bond markets will see through any shenanigans, and punish the issuer severely.

So here is a novel situation where the bond markets could emerge as vital players in the transition to a green economy. The enormous investment potential of the bond markets is there to be tapped to finance green investments – but has been done so only in a minimal way until now. The ideological insistence of the UN and the parties to the Kyoto process that all green investments should emanate from tax-based public sources (which could manifestly not finance the transition in any realistic manner) has now been overcome.

The big guns of capitalism are about to be employed. And the big investors – institutional, pension and insurance funds, which have between them over \$70 trillion in investable funds –

¹⁴ See the Green Finance Mapping report of the IDFC, representing the leading development banks (IDFC 2013).

¹⁵ See Mathews and Kidney (2012) for a discussion of the rationale informing climate bonds.

according to the OECD – are now becoming actively involved, thanks to bond issues like that of the Kexim Bank.¹⁶

Let us be clear as to the size of the global financial system and its capacity to fund investments at scale in renewables and resource efficiency. According to McKinsey Global Institute, financial assets in 2012 totalled \$225 trillion – as good an estimate of the size of the global capitalist system one is likely to get. Of these vast sums, \$50 trillion was accounted for by equity capital (stocks and shares traded on the world’s stock exchanges), while bonds in total accounted for twice this sum, or \$100 trillion.¹⁷ The balance was made up by loans, both securitized (capital markets) and non-securitized (bank lending) (Fig. 8).

Figure 8 Global financial assets, 2012, about here

Most of the projects that professional fund managers find themselves being presented with involve fossil fuel energy systems and unacceptable levels of carbon emissions, and for this reason such projects present unacceptable risks of default. For the most part, the kinds of low-carbon projects that they would like to invest in are unsuitable, in that they are small, or under-insured and guaranteed, or are found in emerging markets where risk spreads are high. So there is scope here for some innovative financial institutions to step forward with investment vehicles (bonds) that overcome these obstacles.

Development banks such as the China Development Bank (CDB) and Brazilian Development Bank (BNDES) can be expected to play critical roles, as they adapt their lending policies to the needs of green sector investments. The BNDES has already developed preferential loan schemes utilizing sociotechnical criteria to identify eco-favorable projects, while the CDB has pioneered the role of bonds as financing vehicles in China, setting the stage for the next step of issuing climate bonds to eco-worthy projects.¹⁸ Other NDBs are moving into the green bonds space as well. Just in July this year the German Development Bank (KfW) announced that it had issued a green bond to the value of Euro 1.5 billion (~US\$ 2 billion) – the largest such green bond issued by a national bank to date. The issue was oversubscribed – revealing the extent of the demand for such green financial instruments from professional institutional investors.¹⁹

So the issue for developing countries with access to national development banks is to fashion cleantech projects in such a way that they can be scaled up to access lower-cost credit, e.g. from bond markets, where the country’s NDBs can secure loans at interest rates just marginally above sovereign government debt. Tapping the private financial sector, without succumbing to malignant financialization, is the critical issue. Here the role of investment banks, with their direct channeling of finance to the private sector, and their capacity to mobilize (or catalyze) private finance towards productive ends, is critical.

The bond markets are, then, the true drivers of capitalism – and the markets that have to be tapped if the world is to make any progress in shifting to a low-carbon industrial trajectory.

¹⁶ See the report from the OECD Finance, Insurance and Private Pensions Department in August 2012 by Kaminker and Stewart (2012).

¹⁷ Of the \$100 trillion bonds market, \$47 trillion is accounted for by government bonds, \$42 trillion by financial-sector bonds, and \$11 trillion by corporate bonds. See McKinsey (2013) for further details.

¹⁸ On the China Development Bank and its lending initiatives, see Sanderson and Forsythe (2013).

¹⁹ See “Big EU banks pile into green bonds, China poised to follow”, by Sophie Vorrath, *RenewEconomy*, 16 July 2014, at: http://reneweconomy.com.au/2014/big-eu-banks-pile-green-bonds-china-poised-follow-20255?utm_source=rss&utm_medium=rss&utm_campaign=big-eu-banks-pile-green-bonds-china-poised-follow-20255

Green bonds have the virtue that they are able to lump together several projects, each one of which might be quite small and have difficulty in securing funding – on its own. But if aggregated or bundled into a single portfolio of similar (but carefully scrutinized) projects, they are much more attractive to investors. In this way, green bonds are an instrument which by aggregating projects is able to overcome the liability of smallness (diseconomies of scale) and thereby cheapen the cost of capital. Secondly, they overcome the problem of guarantees by arranging for government or multilateral guarantees of the bonds, as part of their design and implementation. The bond-issuing institution plays the role of agent, securing the necessary guarantees based on the credit-worthy character of the projects it is investing in. And third, the majority of projects will in fact be found in emerging market countries, where the renewable resources of sun, wind and water and land can be found in abundance, and where risk premiums would act as a block on investment without safeguards. It is the task of the bond-issuing financial institution to arrange for such safeguards, taking responsibility to test the market with bond issues that pay less attention to traditional risk premiums and more to the low-carbon character of their underlying investment projects. A credible standard certifying to the “green” character of the bond is needed – such as the standard issued by the Climate Bonds Initiative.²⁰ If the market does not accept such bonds at just a few basis points above normal then the exercise will have failed, and the world will still have a problem on its hands.

5. Effective development banks: China Development Bank, BNDES, Kexim; the BRICS New Development Bank

National Development Banks are critical components of the industrialization process – as well understood by the BICs with their existing national development banks such as the CDB and BNDES and Indian Exim Bank, and now in 2014 by the creation of the BRICS’ New Development Bank (NDB), created at the BRICS 6th Summit in Fortaleza in Brazil in July 2014.²¹

National development banks are widely discussed, and are viewed as necessary complements to technological and skills-based approaches to development. If they did not exist they would have to be invented.

If there is a case to be made against national development banks it is that they might duplicate what the private sector would do anyway, and that they thereby “crowd out” private investment. These are tired arguments, largely based on self-interested pleading from private financial interests. Firstly, the private sector does not assume the risks involved in driving investment towards new ends such as industrial restructuring (in the early phases of industrialization) and greening (in later phases). The risks involved can only be borne by a

²⁰ See “A change of heart on investing in the climate”, by Sonia Kolesnikov-Jessop, *New York Times*, 27 Nov 2011, available at: <http://www.nytimes.com/2011/11/28/business/global/28iht-RBOG-BONDS28.html>. For the latest on climate bonds standards, see the dedicated webpage at: <http://standards.climatebonds.net/>

²¹ The BRICS group (Brazil, Russia, India, China and South Africa) announced the setting up of two new finance and development institutions at the 6th BRICS Forum held at Fortaleza, in Brazil, in mid-July. The Bank is to be capitalized initially at \$50 billion with equal contributions from each partner, while the complementary Contingency Reserve Fund is to be capitalized at \$100 billion with contributions mirroring countries’ size. The BRICS New Development Bank (NDB) is to be based in Shanghai, with an Indian as its first president and a Brazilian as chairman of the Board. See “BRICS group of nations set up development bank to rival IMF, World Bank”, *South China Morning Post*, 16 July 2014, available at: <http://www.scmp.com/news/china/article/1555232/brics-development-bank-be-headquartered-shanghai-first-president-indian>

public institution – and in its absence, the needed investments are not accomplished. Africa provides the prime (negative) case study on this topic. And funds invested by the NDB actually “crowd in” complementary private finance, which is able to tap into profitable opportunities once the public bank has opened up the field.²²

Now attention is turning towards the role of national development banks in the greening of development. The Inter-American Development Bank based in Washington, DC, issued an important report in 2013 on climate finance and the role of national development banks (IDB 2013). This report makes the point that tax-based public funds will prove inadequate in the face of the enormous infrastructure investment challenges of greening the BICs’ industrial systems as an economic imperative. The core elements of the capitalist financial system – the bond markets – will inevitably be drawn on, and NDBs will have to play a role in catalysing this new development.

The scale required is estimated in the trillions of dollars by responsible agencies such as the IEA and OECD. Mathews and Tan (2014c) have put a dollar figure on the flows of funds needed -- \$3.75 trillion per year for the next 20 years, to effect the transformation of the current fossil-fuelled energy system to one that is based on renewables and resource recirculation. Only the world’s bond markets and the world’s institutional investors can provide the source for such scale of investment needed.

China Development Bank

The China Development Bank (CDB) is one of the world’s largest development banks, eclipsing the World Bank and other multilateral banks such as the Asian Development Bank and African Development Bank. The CDB has specialized in providing long-term credit for Chinese cleantech companies, enabling them to withstand fierce international competition. As a policy bank it does not take deposits from savers, and instead raises finance on the Chinese bond market (and in the process stimulating the creation and expansion of such a bond market). Apart from its definitive interventions within China’s own development (driving the process of urbanization through turning land into collateral), it now operates as the principal arm funding both China’s outreach to develop oil and gas supplies from around the world, as well as providing long credit lines to renewable energy companies (wind and solar PV initially) which have underpinned their rapid rise in international competition.²³ The CDB makes loans at preferential interest rates to projects which fall within the designated “strategic industries” of the current 12th Five Year Plan, thereby effectively operating a loans system that is biased towards eco-finance.

Brazilian Development Bank

The Brazilian Development Bank (BNDES), founded in 1952, is now one of the world’s largest national development banks (and it too is larger than the World Bank). It is a highly important institution that has been at the forefront of Brazil’s development efforts – and now leads in the fostering of green finance, or the financing of green development.

The BNDES is moving from a process where the evaluation of funding proposals was largely focused on the “financials” (risk, guarantees, credit-worthiness of borrower) to one that also

²² For a sympathetic treatment of the Brazilian neo-developmental model and the role played by the BNDES, see Hochstetler and Montero 2013). For an argument that the BNDES has not made much difference to Brazil’s industrial development strategy, see Lazzarini et al (2011); these arguments would carry more weight if they were based not on comparative static analysis but on longitudinal analysis that captures dynamic effects.

²³ See Sanderson and Forsythe (2013) for an illuminating account of the role of the CDB in both extending China’s fossil fuel supply lines and underpinning the internationalization of renewable energy companies.

captures sustainability of the projects themselves and contributes to the formation of a green economy (i.e. what could be called eco-finance). Both aspects are important. The Bank is now developing a series of **sociotechnical guides** as to what constitute the criteria by which sustainability may be evaluated, as well as financing initiatives that contribute to green development, such as reforestation, building value chains for renewable energies, and promotion of green technologies.

The key idea is that loans from the Bank will carry a sliding scale of charges, with the lowest charges for projects that meet all sustainability criteria and the highest for those that fall short. In order to implement this strategy, the Bank has been preparing a series of guides that document the sociotechnical best practice benchmarks for low-carbon and ecologically sustainable production – sector by sector. These are to be utilized to provide parameters against which funding proposals may be judged. The idea is that applicants for funding who can demonstrate their compliance with these sociotechnical sustainability criteria will be charged the Bank's going rate; those that can do better (contributing to raising the bar, or improving the benchmark) will be offered loans at discounted rate (say, 1 percent lower). The Bank reserves the option to raise the sociotechnical standards from time to time, even above those required by minimal legal/environmental standards. Agreement would be sought with the industry in most cases.

This promises to be highly effective as a means of encouraging business to raise its green standards -- a way that is much more effective than, say, a carbon tax or cap-and-trade scheme. This is because it is imposed at the point where funding decisions are being taken. It carries no bureaucratic overload; it is transparent and fair, in that a company can see what are the designated sustainability criteria and whether it meets them or not; and it is applied at the point of investment, rather than after the fact, where extra expenditure might be required once the production system has been set in place. Moreover these guides are adapted to the conditions in which industry is conducted in Brazil; they are not imposed by some external authority.

These sociotechnical guides are anticipated to become the defining documents of the green economy as it develops in Brazil. They are highly practicable, in that they have input from trade and industry associations and are based on prior discussions with experts in the industry. They require Board approval by the Bank prior to being implemented in lending decisions. In this way they carry authority and are rendered immune from legal challenges that construe the practice as discriminatory. In effect these documents provide a baseline or standard which firms need to reach if they are to qualify for loans.

The practice of graduating loan charges depending on adherence of applicants and projects to sociotechnical guidance is in its infancy in Brazil; at last up until mid-2012 no loans had been offered within this framework.²⁴ But its application is imminent, and demonstrates enormous potential. The closest parallel to it is graduated charges imposed by state-owned Chinese banks such as CDB to projects which are targeted by the current Five Year Plan as opposed to those that are not.

6. Why national development banks outperform carbon markets and equity markets

²⁴ Interview at BNDES with Sergio Weguelin, then head of environment activities, in February 2012.

The national development banks provide direct financing to firms and industries as they seek to initiate new lines of investment in cleantech operations. The contrast with “carbon trading” has to be underlined. The idea that pollution allowances (carbon offsets) could be traded and that the carbon markets so created might drive investment in the desired direction, has now been shown to have little potential – given the dismal performance of the European Trading System (ETS) and collapsing carbon prices elsewhere. But to tap into the bond markets is a real form of green finance, and one where Seoul and the Korean Exim Bank may just have seized the initiative away from Wall Street, Frankfurt and London.

The problematic effects of resorting to carbon markets as a means of mitigating carbon emissions can be demonstrated by examining how some carbon offsets proposals would strangle climate bonds markets at birth. To take a specific case, in June 2010 the International Emissions Trading Association (IETA) issued a draft discussion paper on linking climate bonds to carbon offsets. While welcome as a means of furthering discussion on green bonds and how they might be used to accelerate investment in renewable energies and energy efficiency, the paper betrayed the top-down thinking that poisoned the Kyoto process and made the Clean Development Mechanism almost useless as a means of reducing real carbon emissions on any scale (a point on which the IETA itself surely agrees) – even if some individuals and organizations have managed to make money out of it. Along the way, the IETA proposes financing mechanisms – supposedly to be used by emerging industrial giants like China, India and Brazil – that would involve these countries agreeing to subordinate their greening efforts to: 1) having their green bonds approved by an international body; 2) demonstrating compliance by the bond with standards issued by the international body covering monitoring, reporting and verification (MRV) processes; 3) issuing of green bonds to be circumscribed by an over-arching Guaranteed Carbon Collateral Units (issued by whom?) that would set a ceiling on the range and volume of climate bonds to be issued; and investors such as pension funds being expected to accept carbon credits as means of payment in addition to equity or interest payments. Frankly, these are four impossible conditions that would undermine any real climate bonds initiative.²⁵

Likewise, global equity markets, while offering invaluable support, are unlikely to do the heavy lifting (even through the role of venture capital). For one thing, globally the bond markets are around three times the size of the equity markets (consisting of traded shares in listed corporations).²⁶ But the main reason is that bonds have arguably the greater power to aggregate investment projects across multiple lines, to reach ‘investment grade’ that would be attractive to institutional investors – lowering the cost of capital and reducing risks and uncertainty. Equity (share capital) by contrast is tied closely to the performance and prospects of individual companies and their managements, and can be side-tracked by concerns over individual earnings by senior management – as is evident in the past decade in the US with the strong trend towards share buybacks undertaken to drive up share prices and enhance the value of executives’ stock options (Lazonick 2011).

²⁵ See my (somewhat negative) comments on the IETA draft Discussion paper, “Why, I’ve believed as many as six impossible things before breakfast” at the Climate Bonds Initiative webpage, available at: <http://climatebonds.net/2010/06/why-sometimes-i%e2%80%99ve-believed-as-many-as-6-impossible-things-before-breakfast%e2%80%a6/>

²⁶ McKinsey’s report on *Mapping Global Capital Markets* in 2011 estimated the size of the global capital funds market as being \$212 trillion – of which bonds (debt) markets accounted for \$157 trillion, and stocks (equities) for \$54 trillion (McKinsey 2011).

7. Conclusions

Greening is a process, not an end point. There is no such thing as “green capitalism”. But an industrial capitalism that is greening is feasible and necessary – because the conventional model for industrial development will not scale and will create unbearable points of geopolitical tension if business as usual is allowed to continue.

So the next round of industrialization is taking on a greenish hue – and is being led by the emerging industrial giants of the 21st century, China, India and Brazil. It is greening viewed not as a moral imperative but as an economic imperative – because, as Hu puts it, this is “the inevitable choice for China” and for the other BICs. Alongside the conventional fossil-fuelled industrial system that they are creating at enormous scale, there is emerging a complementary green growth sector of the industrial economy, now expanding even faster than the black, fossil-fuelled system.

But mobilizing finance and catalysing investment from the private sector is the principal challenge, and this is where NDBs are proving to be of prime importance. They are the institutional vehicles through which investment flows can be channelled to new, greening purposes – for renewable energy projects and resource recirculation, to meet energy security and resource security concerns. And they are the institutional vehicles through which the international capital markets and institutional investors can be tapped – through the creation of appropriate financial instruments such as green bonds. Kexim has shown the way – now it is up to other NDBs to follow this lead and formulate their own green bond issuances, and thereby help to pave the way to sustainable green development in the emerging industrial giants China, India and Brazil.

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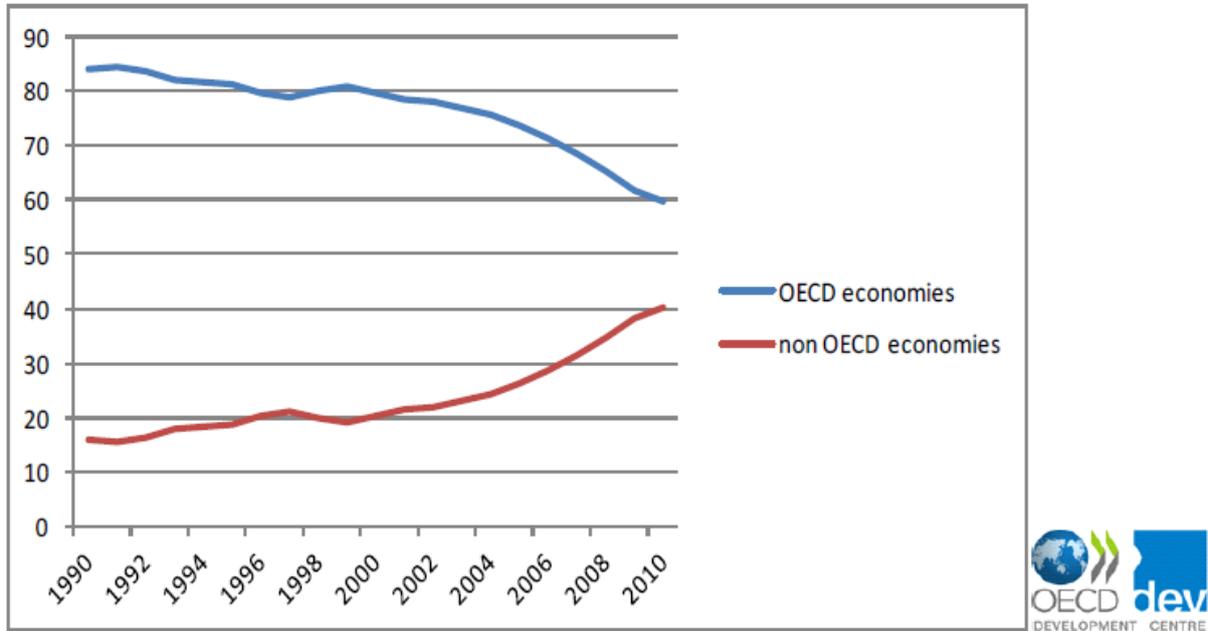
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Figure 1. Shifting wealth

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

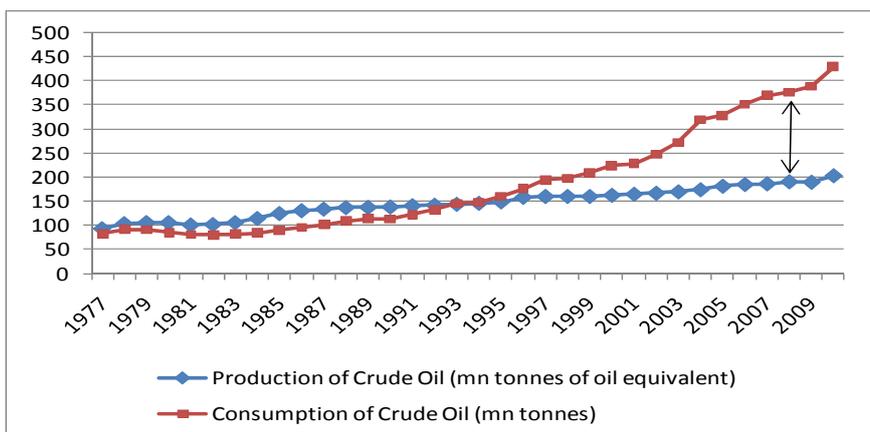


SOURCE: OECD Development Centre based on IHS Global Insight, special tabulations (2011) of World Industry Service database. Note: OECD: no data for Austria, Estonia, Greece, Hungary, Iceland, Luxembourg, Portugal, Slovak Republic, Slovenia.

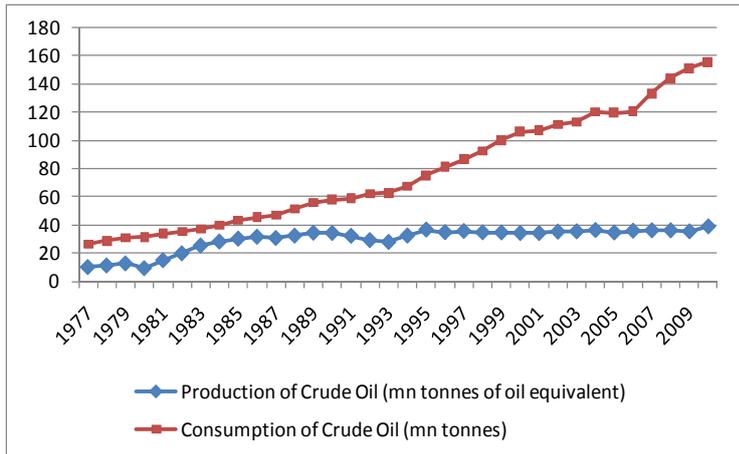
Source: OECD Development Centre

Figure 2. Rising dependence of China and India on oil imports

(a) China

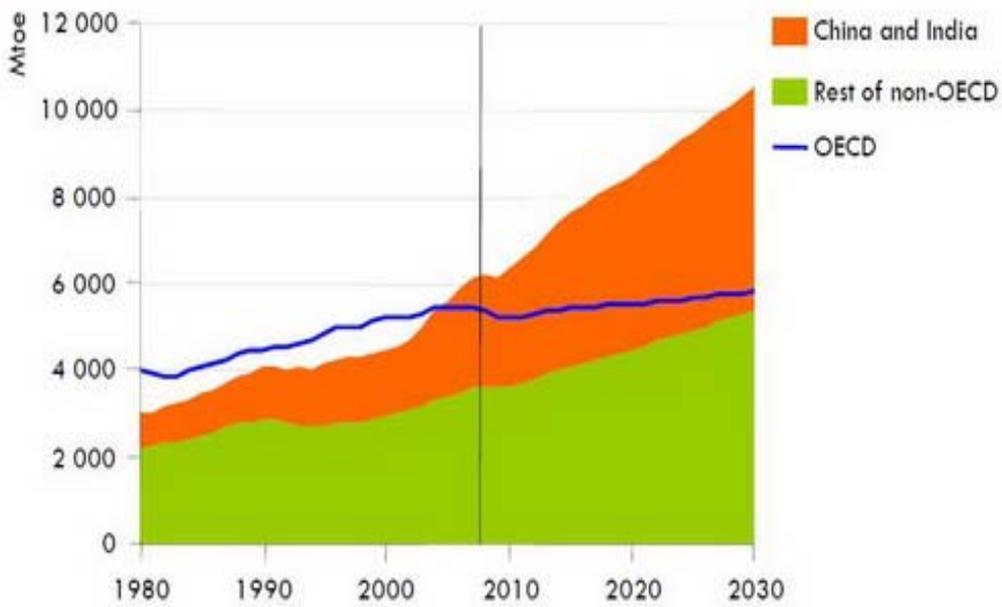


(b) India



Source: Mathews and Tan

Figure 3. Growth in oil consumption will move to China and India

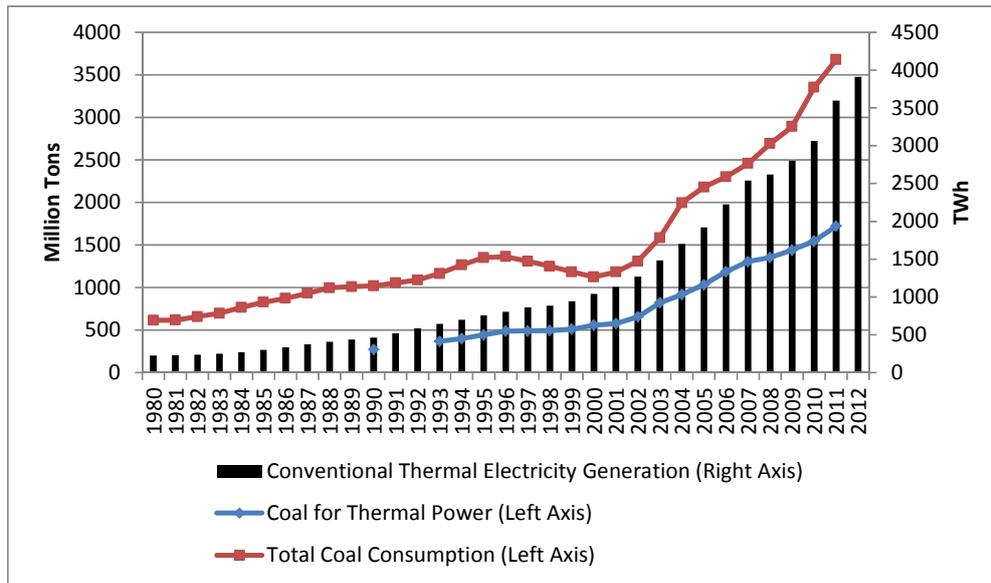


Source: IEA

Figure 4. China's black and green energy faces



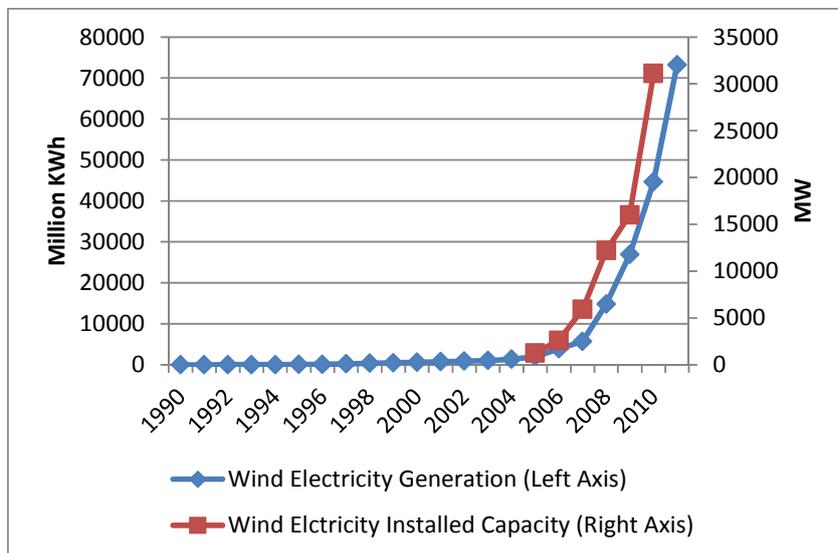
4 (a) China's black face: build-up of thermal power



Source: Mathews and Tan

Source of primary data: the data of the total coal consumption (up to 2012) and thermal electricity generation (up to 2011) is available from the US EIA. The data of coal consumption for thermal power is available from the National Bureau of Statistics of China. The data of the total coal consumption for 2013 is available from the China Coal Industry Association. The data for the thermal electricity generation in 2012 and 2013 is available from the China Electricity Council.

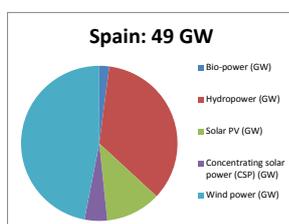
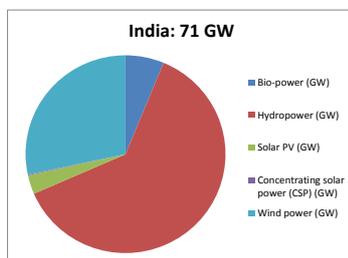
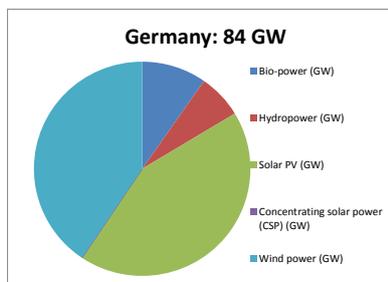
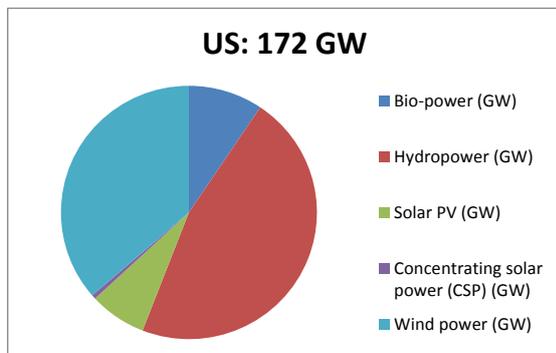
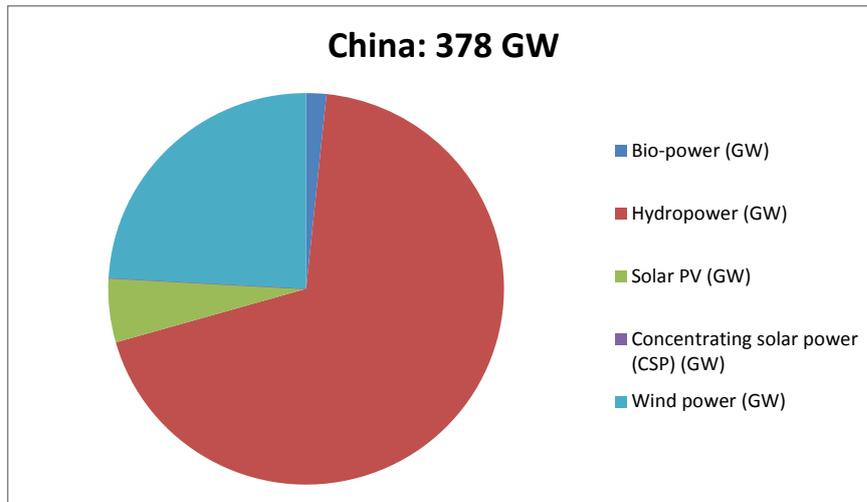
4 (b) China's "green" face: Build-up of wind power



Source: Mathews and Tan

Source of primary data: the data of the wind power generation (up to 2011) and capacity (up to 2010) is available from the US EIA. Other data is available from the China Electricity Council.

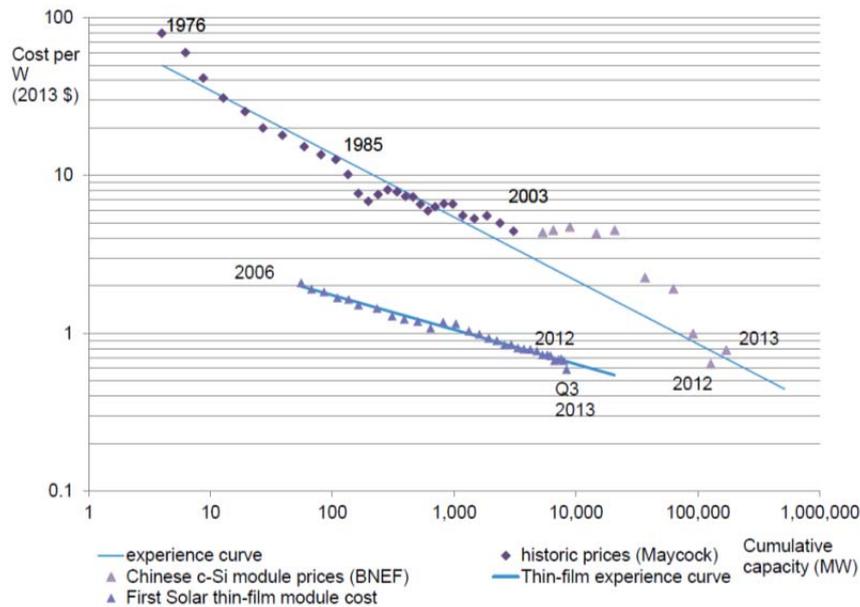
Figure 5. Renewable electric power capacity, China and other countries, 2013



Source: Mathews and Tan

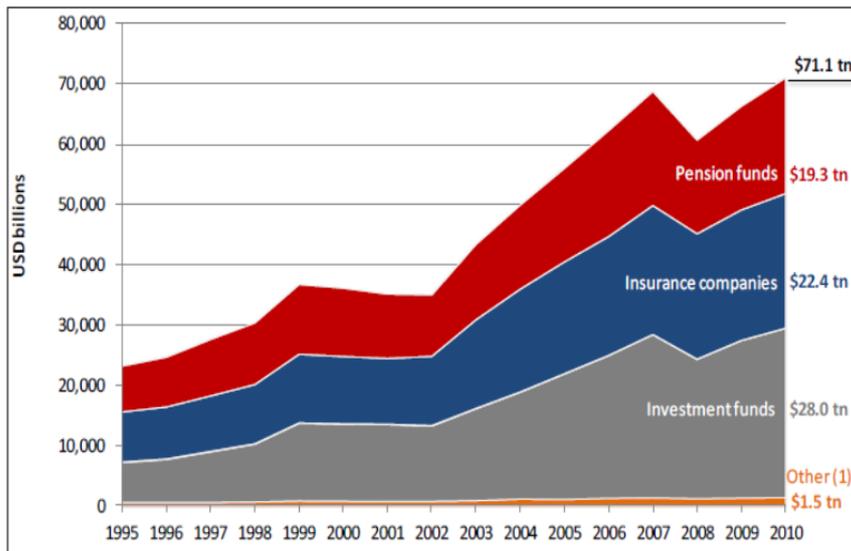
Source of data: REN21(2014) CSR report, available at <http://www.ren21.net/REN21Activities/GlobalStatusReport.aspx>

Figure 6. PV module experience curve, 1976-2013 (2013 \$)



Source: Bloomberg New Energy Finance, available at <https://www.iea.org/media/workshops/2014/solarelectricity/BNEF2LCOEofPV.pdf>

Figure 7. Funds under management by institutional investors

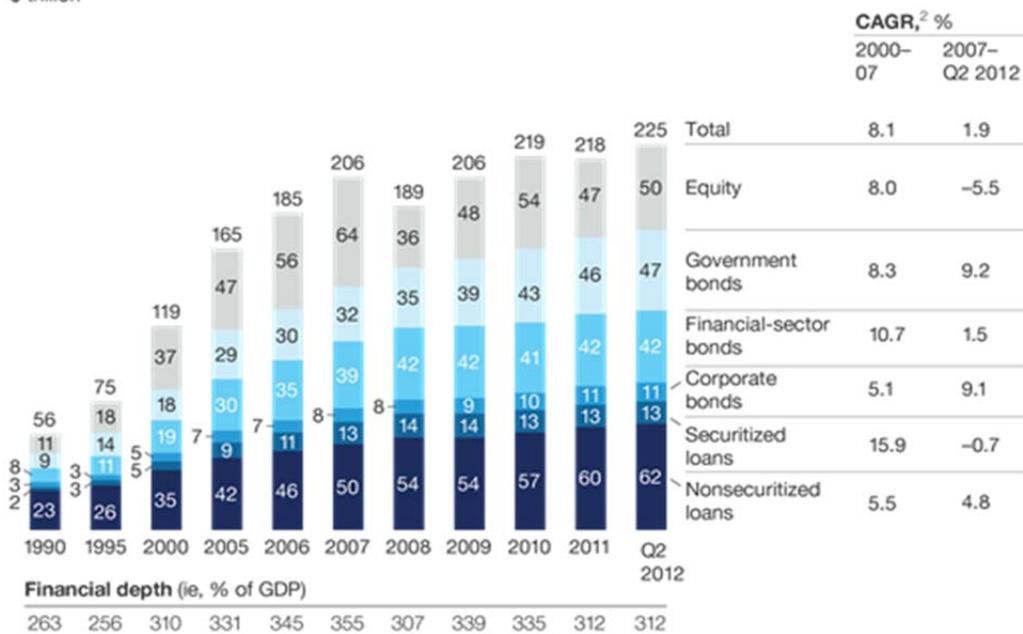


Source: OECD Global Pensions Statistics and Institutional Investors databases and OECD estimates¹⁵

Source: Kaminker and Stewart (2012), Fig. 2

Figure 8 Global financial assets, 2012

Global stock of debt and equity outstanding, \$ trillion¹



¹End-of-year figures for a sample of 183 countries, based on constant 2011 exchange rates. Figures may not sum to totals, because of rounding.

²Compound annual growth rate.

Source: McKinsey Global Institute analysis

Source: McKinsey Global Institute, *Financial Globalization: Retreat or Reset?* March 2013