National strategies for competitive advantage and growth through cleantech

John de Yonge
Director, Account Enablement
Global Cleantech Center
Ernst & Young

As the world shifts to a resource-efficient and low-carbon economy to address the rising consumption of energy and raw materials, many countries are embracing national cleantech strategies to position themselves for economic competitiveness and growth. For reasons ranging from creating jobs, to incubating high-value industries, to achieving energy security, gaining efficiencies or combating environmental degradation, many governments are making cleantech innovation, adoption and exports a top priority.

While each country is pursuing a different path to cleantech adoption for national advantage, their governments have played pivotal roles in the sector's development. From Denmark's pioneering embrace of wind energy to China's massive cleantech investment, here are several snapshots of national processes and plans in pursuit of cleantech-driven development.

Denmark: an early cleantech adopter moves into electric vehicles

Decades ago, Denmark set itself apart by embracing wind as an energy, jobs and economic engine. Denmark's early renewables success shows that even small countries can achieve great things with a coherent cleantech strategy.

The 1970s oil crisis first sparked Denmark's determination to be energy independent. Today, wind generates 20% of Denmark's energy from over 5,000 turbines, a percentage pegged to rise to 50% by 2020 with a growing portion from offshore. To boost offshore wind production, new government incentives include citizen share-price purchases of turbines, loan guarantees and a scrapping scheme with payments for owners of older turbines who retire them.

Along with reducing Denmark's dependence on fossil fuels, these initiatives have made Denmark the world leader in the wind industry, with a 40% share of the global wind turbine market. Danish company Vestas is the world's largest wind turbine manufacturer. The country also boasts world-class and comparatively low-cost wind research and development (R&D) clusters that draw investments from big names including Suzlon, Siemens Wind Power and Gamesa. As a result, since 2000, cleantech exports have grown three times faster than total exports to reach US$11.7 billion in 2008 – the largest quantity of European exports in that category. New, more efficient turbines portend even greater growth.

To build on these achievements in its quest for 100% fossil fuel independence by 2050, Denmark's Government has committed US$2 billion to cleantech. The country's ambitious goals include deploying 400 megawatts (MW) of new offshore wind turbines by 2012; renewables kicking in 10% of total energy for transport; cutting greenhouse gas emissions 20% from 2005 levels; reducing energy use 4% by 2020 from volumes consumed in 2006; and tripling wind capacity by 2030.

In transportation, the Danish Government is encouraging electric vehicle (EV) adoption through fossil fuel taxes, tax-free sales of hydrogen vehicles and EVs through 2012, and the provision of EV research funds. As a result, big names like Mercedes-Benz, Better Place (with DONG Energy and Renault Nissan), Saab, Volvo, Tesla and BYD plan to enter Denmark's hybrid and EV markets. Subsidies are also flowing into municipalities, companies and industry associations for R&D and tests on the required infrastructure, and to study the potential of storing and sending excess EV power back to the grid when wind energy falls.

Collectively, Denmark's showcase cleantech and fuel efficiency programs – which drove consumption down more than 2% from 2007 to 2008 – have made it a global model for cleantech-led development.

China: the emerging clean energy leader

When it comes to size, population and output, China is all superlatives. And energy is no exception. China's energy consumption is expected to surge 75% by 2035, according to the International Energy Agency. Today, roughly 75% of China's electricity comes from coal.

To meet its vast energy needs, curb pollution from coal, cut foreign oil dependence and spark innovation and economic growth, China's Government is taking an orchestrated approach through clean energy-friendly laws, funds, incentives and standards. Renewables now rank as a key development sector to meet the needs of a country that is both industrializing rapidly and urbanizing rapidly as citizens migrate from rural areas to join the growing middle classes in its densely populated cities. China's US$586 billion economic stimulus plan alone earmarks roughly 37% of spending for cleantech projects, mostly in the renewable energy and smart grid areas. As a result of such initiatives, China scored the number one spot on Ernst & Young's global *Renewable Energy Country Attractiveness Index* in 2010.

Driving long-term action is China's 12th Five-Year Renewable Energy Plan, which calls for boosting renewables use, improving energy efficiency, and fostering cleantech R&D. The country's energy plan targets renewables as 15% of China's energy mix by 2020 and 33% by 2050, from nearly 10% in 2009, as well as shrinking the country's energy carbon intensity 45% by 2020. Regulations now require that grid companies purchase all renewable energy generated locally, and provide new state incentives and funds for cleantech projects such as the construction of independent power systems in remote areas and islands, often with regionally produced machinery.

Though China's solar sector caught the world's eye several years ago, wind is now at China's back. China was home to half of all newly operational wind turbines worldwide in 2010 and has plans to grow its installed capacity for wind to 100 gigawatts (GW), and for solar to 20GW by 2020.

Offshore wind is a particular priority, and bidding and tenders are underway in 11 provinces. Noteworthy projects include China's first offshore demonstration project near the East China Sea Bridge in Shanghai, and Sinovel's planned 5MW turbine manufacturing plant in Yangcheng for the country's first offshore wind-powered high-tech industrial base. Other big wind turbine makers, such as CNOOC, Vestas and Siemens, are leading or eyeing opportunities stemming from the country's target of 5GW of offshore capacity by 2015.

Other growing cleantech focus areas include electric vehicles (EVs) and smart grids. A US$15 billion government plan aims to have 5 million electric and plug-in vehicles and 15 million conventional hybrids on the road by 2020. To boost the production capacity of hybrids and EVs to about 500,000, the state will spend US$1.4 billion in the coming three years alone. China's State Grid Corporation also plans US$586 billion in smart grid R&D and rollout investments by 2020.

But solar is still a focus. The country's "Golden Sun" program provides subsidies for 500MW or more of photovoltaic (PV) power projects by 2011. They are earmarked for building-mounted, grid-connected PV, stand-alone PV power, large-scale grid-connected PV solar farms and other projects, with half of total PV project investment and transmission costs covered in cities and 70% in rural areas. China is also funneling about US$12.2 billion into emissions reduction and conservation spending.

Chinese clean energy companies and projects received investment of US$51.1 billion in 2010 – 21% of all global investments in clean energy, according to Bloomberg New Energy Finance (BNEF). With an expected US$738 billion spend on clean energy sources over the next decade, China is the global cleantech opportunity.

India: a national solar mission

Ramping up India's power supply to accelerate industrialization, create new cleantech industry clusters, serve its growing cities, and cut poverty and C02 emissions drives India's interest in renewables. The power deficit in the world's second most-populated country averaged nearly 13% during peak hours in the year ending March 2010. India is also the world's fourth most-polluting nation.

India imports almost 75% of its oil, with renewables contributing just 10% of its energy mix. Reducing renewable energy technology costs is thus a top state goal. Given India's success with software and business process outsourcing, its potential is promising, particularly in solar, a relatively untapped and unlimited resource.

Investors see opportunity. Clean energy asset financing in India skyrocketed to US$3.4 billion in 2010 from just US$560 million in 2004, according to BNEF, for a robust 35% compound annual growth rate.

Wind accounts for 70% of the renewables mix in India, followed by hydro (16%), waste-to-energy and biomass. But to accelerate cleantech adoption at its factories and farms, the nation recently singled out solar energy for development.

India's National Solar Mission (NSM) targets a twentyfold growth in its installed solar capacity sourced from the country's abundant solar irradiance. As many as 330 average sunny days a year in India at many sites make solar energy an attractive proposition. The country's average daily insolation of 4–7 kWh/m2 adds up to a potential of more than 100GW.

In particular, the NSM seeks 1GW in installed solar capacity, of which 60% would be solar thermal and 40% PV, respectively. Key goals to get there include improving solar cell efficiencies by 15%, achieving grid parity by 2022 and fostering entrepreneurship and technology transfer. Some 1,100MW for India's grid-connection plants is targeted for the first NSM phase through 2013, encompassing roughly 100MW of rooftop and small tail-end solar plants.

Companies such as Tata BP Solar, Websol and Titan Energy are eyeing technology and manufacturing joint ventures and partnerships to participate in NSM project allocations.

Finally, India, like China, is prioritizing power for remote rural villages, via solar PV home-lighting systems, small hydropower projects, biomass gasification and biogas engines. It also plans to replace diesel with PV systems in industry and telecommunications towers. The Government hopes to electrify 10,000 villages by 2012.

South Korea: smart grid and electric vehicles pave the way

When it comes to small countries making big moves, South Korea is today's front runner. This often-overlooked electronics powerhouse – which ranks 10th globally for energy consumption and 9th for CO2 emissions – plans to plow some US$36 billion into alternative energy by 2015, led by the private sector.

Driving interest and investment in Asia's fourth-biggest economy are its 50% dependence on energy imports, growing population, rising incomes and CO2 emissions. The country also seeks to grow its global share of the renewables market by developing innovative wind, solar, hydrogen fuel cell, smart grid and EV products.

South Korea's ambitious Green Growth program aims to make South Korea the world's seventh green power by 2020, and its fifth by 2050. The Government believes some 500,000 new jobs, 230 million tons less carbon dioxide, and 440 billion fewer imported barrels of oil will result from its smart grid efforts by 2030 in a market it values at US$54 billion. Other expected benefits include a 3% fall in power consumption, a 4% drop in emissions from 2005 levels by 2020, and a 15% decline in consumer electricity bills.

A particular focus is on EVs and smart grids, with domestic leaders Hyundai and GM Daewoo championing EVs through their BlueON and Lacetti cars, respectively. The country hopes to produce 1 million EVs and install 2.2 million charging points by 2020, encouraged by tax benefits for EV owners.

Finally, South Korea's US$24 billion plan for a nationwide smart grid by 2030 – the world's first – aims for 30,000 charging stations at malls, parking lots, gas stations and public buildings by then. The South Korean Government also views smart grids as a strategic export industry.

Brazil: diversifying its renewable energy supply

South America's biggest country is best known for its sugar cane ethanol, which emerged as a petroleum substitute during the 1970s oil crisis. But Brazil has long been a clean energy pioneer. Nearly half its energy is renewable today versus the worldwide average of 13%, led by hydropower.

For Brazil, cleantech is a solution to problems wrought by fast economic and population growth. To meet demand for more varied and greater volumes of energy sources for its rising middle class, burgeoning cities and rapidly industrializing regions, the world's fifth most-populous nation is deploying a coherent and targeted renewables-driven strategy. Brazil is the world's 10th biggest energy user.

Among Brazil's current cleantech sources, its 22 million gallons of ethanol distilled per day make it the world's second-biggest producer and meet roughly half of Brazil's domestic fuel needs. Hydropower from the massive Amazon and its tributaries also provides an impressive 84% of its electricity. Brazil trails only China and Canada in hydropower production.

But deforestation, population displacement and power disruption from drought have pushed Brazil to diversify into small hydro, wind and solar power, and to harness feedstock by-products like sugar cane bagasse.

For a sense of the country's commitment to alternative energy, look to Brazil's national cleantech strategy for 2022. Government targets include boosting Brazil's clean energy generation capacity by 11.5GW by 2019, with no new fossil fuel plants commissioned after 2013; installing smart meters in each of its roughly 62 million homes by 2020; cutting carbon dioxide emissions 40%, increasing biomass and wind energy tenfold; and tripling ethanol production to 75 billion liters, all by 2022.

To date, Brazil has captured just a tiny fraction of its total wind potential of 143GW, prompting its Government to focus on this largely untapped resource concentrated on its Eastern coast.