



The CO2 Challenge: Optics vs Options, a View from Hong Kong

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Worldwide, actions to reduce the carbon footprint of our energy supply have yielded only modest results. Wind and solar have made obvious progress, but have failed to dislodge baseload coal, and are not optimal solutions in all geographies. When formulating sustainability strategies, details matter. Few places have access to all the currently feasible renewable energy resources. Some, like Hong Kong, have comparatively little. The challenge is to take a measured look at reality and recognise that a lot more innovation is essential, as is some form of international trading, carbon charge, or access to offsets. We take a closer look at Hong Kong, the home of The Lantau Group, and which has recently sought to develop a climate strategy. Hong Kong's experience highlights the difficult nature of the problem and suggests that new approaches continue to be required.

Key Points

- We are not winning. Progress in scaling up renewable energy sources has gathered pace but what might work in one area need not work in another. Local geographic, socio-economic and resource characteristics can impose constraints on appropriate mitigation strategies. A city like Hong Kong can do many things, but each is small, leaving a major on-going challenge that still needs to be met.
- Some of the most common approaches, including those like Hong Kong's fuel mix target, may seem obvious, but they can also be expensive, and despite near-term benefit are insufficient to address the longer-term problem, raising the important question of whether they are worth the money expended compared to other options.
- A great deal more innovation is required, and this can most effectively be supported by governments, each of which faces different challenges. Also, given the diversity of options and locations, more flexible mechanisms, such as carbon trading and carbon taxation, are crucial. It is about time that Asia's economies – particularly those like Hong Kong with the financial capacity to lead – embrace new approaches as part of a longer term strategy.

Responding to Local Characteristics

Despite all the talk on climate change and the very real increase in renewable energy development, one conclusion is stark. We are not winning. In the last fifteen years, after all the headlines and the advances and the investments, the share of low-carbon primary energy used in the world has crawled from about 14 percent to 15 percent according to statistics from BP's most recent Energy Outlook. We haven't made a difference.

This is not for want of effort. By way of just one example, China is attempting a major energy transition. The country has driven significant efficiency improvements in how it generates electricity, has massively expanded its wind and solar generating capacity, and has imposed ever more stringent emissions standards. Yet it has failed to achieve the kind of emission reductions necessary.

What is clear is that what works in one place need not work in another. France has a long tradition of nuclear power; across the water in the UK there is rather more antipathy to the technology. China has relied upon its domestic resources of cheap coal; neighbouring Japan, lacking such indigenous resources, has imported LNG and focused on energy efficiency.

When thinking about how to lower the carbon footprint of energy systems, keeping such local differences in mind can help us remember to start from a characterisation of local constraints, rather than simply rushing to some off-the-shelf solution. Different resource endowments, economics and energy habits will determine different sensible climate strategies.

In this paper, we focus on Hong Kong. Hong Kong's energy sector is neither peculiarly large and polluting, nor easily transformable through some ready-made solution. We select Hong Kong precisely because its local peculiarities make finding a solution, or even visibly demonstrating commitment, that much more difficult.¹

Controlling the Fuel Mix

54 percent of Hong Kong's total energy budget is consumed as electricity, which accounts for roughly 70 percent of the city's carbon emissions. Changing how its electricity is generated might therefore seem an effective way to meet the Government's carbon intensity target of a 50-60 percent reduction against a 2005 benchmark by 2020.

It is unfortunately easy to dismiss the opportunities for renewable energy in Hong Kong.² The city's lack of open space makes significant utility scale solar power infeasible, despite the generally good solar resources found in Hong Kong and the rest of Southeast Asia that have given the technology a strong value proposition in meeting daytime peak loads.³ Low wind speeds make wind an even less compelling technology for Hong Kong.

The expansion in renewable energy generation has not translated into a significant increase in the low-carbon share of primary energy.

Local characteristics determine local solutions; we use Hong Kong as a case study to highlight why a broader set of options, including carbon trading, is important.

Hong Kong plans to reduce carbon intensity by 50-60 percent by 2020 (from a 2005 baseline), but the options for domestic renewable energy are limited.

1 A further reason for picking Hong Kong is that cities account for nearly 80 percent of the world's energy use and around 60 percent of global CO₂ emissions. (Hong Kong Environment Bureau (2015) *Hong Kong Climate Change Report 2015*. Retrieved from <http://www.enb.gov.hk/sites/default/files/pdf/ClimateChangeEng.pdf> (accessed 23 January, 2017))

2 The Government of Hong Kong estimates that current renewable energy technologies could only contribute 3-4 percent of Hong Kong's electricity needs. Higher values are not impossible and should be pursued, but each individual project or idea would likely add only a few basis points to the total.

3 The solar panels to generate 1 percent of Hong Kong's electricity demand would cover 3.6km². You could cover the whole of Wan Chai or Sham Shui Po districts (home in 2015 to 150,900 and 390,600 people respectively) and not quite generate 3 percent, none of which would be available to run the traffic lights at night.

The desire to do something visible may be stopping us from being more effective in the longer term.

Despite significant efforts and tangible marquee projects, Hong Kong still comes up short — just like almost everywhere else. Something more is needed.

Rooftop solar panels are unlikely to make a significant contribution given population densities. And, in any case, the apparent value-case for rooftop solar panels is currently skewed by tariffs that are substantially variable (i.e., based on \$/kWh) and thus would enable a building-mounted system to avoid paying for the power grid itself, shifting these costs to other customers. Tidal and wave powered technologies appear still in their infancy. Additionally, nuclear, a low-carbon emitting but high energy-density technology, suffers from the twin problems of low public acceptability and limited construction capacity. Hong Kong currently imports nuclear electricity from the Mainland, but is unlikely to construct its own nuclear plants.

Perhaps as a result, the government has opted instead to support natural gas as the cleanest of the fossil fuels. In 2013, the city's generation mix was 57 percent coal, 21 percent gas, and 22 percent nuclear. The government is now targeting a 2020 mix of 50 percent natural gas, 25 percent nuclear, and just 25 percent coal. Existing coal capacity is set to be retired from 2017; there has been a moratorium on new build coal since 1997.

A provocative but innovative alternative approach might have been to upgrade the efficiency of Hong Kong's 1980s-built coal-fired power plants. While the carbon reduction would not seem at first to be as great as with the shift to gas, modern ultra-supercritical plants are significantly more fuel efficient (and less carbon intensive) than older sub-critical variants. Coal is also much cheaper than gas, so the money saved could be used to champion even larger emissions through longer-term research and development, or through direct investment or trading opportunities in markets with much more favourable resource endowments than Hong Kong. Unfortunately, such approaches have not gained much traction in part because there are relatively few channels or innovative pathways to use financial resources for long-term environmental benefit. There appears a general preference to find tangible things to do, even if they don't yield as much real benefit beyond the optics.

Chasing Enhanced Efficiencies

The alternative to trying to specify the electricity fuel mix is to simply impose constraints on emissions. Policies that target emission reductions may still lead to fuel switching, but they can also promote improved energy efficiency. Alongside Hong Kong's carbon intensity reduction target, the Government has also adopted an energy intensity reduction target of 40 percent by 2025, against a 2005 base.

Like other cities, Hong Kong has its flagship projects. There is a district cooling system at the Kai Tak Development in Southeast Kowloon, and a Zero Carbon Building in Kowloon Bay. The former is meant to use 30 percent less energy than conventional air-conditioning would; the latter is 45 percent more energy efficient than a conventional building, and otherwise powered entirely off renewable energy. For both projects, though, scalability, named expansion plans notwithstanding, remains problematic. Such ideas are unlikely to contribute meaningful near term reductions in energy use. On the other hand, adoption of LED and other similarly energy efficient lighting technologies has soared with brightly lit Hong Kong using much less electricity for lighting than in years past.

A more bottom-up approach being pushed by the Government is to encourage behavioural change. At one level this is about nudging commercial spaces to set air-conditioning to 24-26°C, reducing over-cooling, or, through schemes such as the No Incandescent Light Bulb Charter, enabling retailers to voluntarily pledge to help improve

A jurisdiction, like Hong Kong, with an already low energy intensity will not easily find further material efficiency savings from simple appliance upgrades. A more innovative approach to changing behaviours and preferences is needed.

The most important things that can be done include commitments to longer-term research and development and to mechanisms such as carbon taxation and carbon trading. Are these being neglected in favour of tangible near-term projects with better optics?

energy use outcomes.⁴ At another it is about improving labelling schemes on household and commercial appliances so that customers can more easily choose energy efficient models. The challenge here, of course, is that households do not often replace appliances just to improve efficiency: the related cost savings are seldom sufficient to motivate change. More often, consumers do so when new models have new features in addition to improved efficiency, or when old things break and must be replaced anyway. The important efforts are not just those related to the actual replacement decision. They are in informing consumers of external benefits and in trying to change preferences to better align with sustainability precepts.

Once again, Hong Kong's particular characteristics mitigate against the pursuit of energy efficiency being necessarily easy. A highly densely populated city with limited industry and advanced financial services, Hong Kong's energy intensity (the amount of energy needed to generate one unit of GDP) is already low: lower than Japan's, Singapore's or anywhere in the EU. Efficiency savings are undoubtedly possible, but they are not necessarily the low-hanging fruit of other locations.⁵ Despite rising personal residential electricity use, energy intensity has been falling suggesting annual efficiency gains. This is why the real contribution would be finding ways to enhance popular support for sustainable practices and reinforce emerging consumer preferences for greener product and service attributes. Getting an appliance or light-bulb upgraded is nice, but fostering a new generation of more sophisticated consumers – much more difficult – seems likely to be the better strategy.

Missing Innovation

So what can Hong Kong do? Certainly all of the sensible things. Hong Kong has a clear role to play in advancing innovation in the efficient use of energy through better technology, building materials, systems, design, and integration of transport and utilities. Another area concerns how data and information informs customer usage, system design and operations, and all manner of production and usage efficiencies and service quality enhancements. Electric vehicles have also shown considerable promise in Hong Kong, offering opportunities to explore the best way to enable a transition to zero emission transport systems.

And, of course, despite any limitations of currently developable renewable energy potential, there is no reason to ignore what potential actually does exist. Hong Kong should surely pursue a broad, multi-faceted strategy involving combinations of small to modest developments of existing renewable energy technologies, on-going efforts to enhance end-use efficiency, as well as cost-effective changes to the fuel mix and to existing fuel conversion efficiency.

Realistically, however, Hong Kong's local characteristics currently throw up more problems than solutions when it comes to scaling up traditional renewable energy development potential such as wind, solar, or biomass. Supply side strategies that focus on aggressive development of wind and solar won't fit, and demand-side management is likely to deliver only slow incremental change. These are all good things, but they pale in comparison to the magnitude of the challenge.

The challenge is to use Hong Kong's resources and innovation to reach beyond its boundaries.

⁴ See: http://www.energysaving.gov.hk/no-ilb/en/charter/about_charter/index.html

⁵ The Government has been carrying out (and otherwise encouraging) building energy audits as a way to understand energy use and identify possible savings.

Hong Kong has the financial and other capacity to take the lead in establishing innovative carbon trading platforms in Asia, enabling stakeholders to optimise their emission reduction investments.

A more complete strategy for contributing positively towards global decarbonisation has to involve more than simply looking for that which can be done within Hong Kong. As a global problem, facing countries with highly diverse situations, some reliance on trading or offsets mechanisms remains crucial to finding any solution at manageable cost. The other angle is to contribute more to basic research and development in innovative new technologies.

A focus on research and development is being promoted by 23 governments, including China, as part of the Mission Innovation programme. Each has pledged to double its state-directed clean energy research and development investment by 2021. Through the programme, members aim to support the sharing of information on national priorities and policies, encourage mutually beneficial international collaborations, and work closely with the private sector to increase investment in early-stage companies. Follow through of these pledges will be crucial.

In this, Hong Kong has ample room to engage more proactively. China's state-directed R&D budget grew from about 1.4 percent of GDP in 2001 to just over 2 percent in 2007.⁶ Singapore's reached 2.5 percent in 2002, but has since settled at around 2 percent. Hong Kong's is just 0.7 percent, despite the Government itself calling for Hong Kong to take a leadership position in research.⁷ Hong Kong could capitalise on its competitive advantages and offer far more effective support for energy innovation.

The other area – trading – would seem a natural fit given Hong Kong's deep financial resources and expertise.

Hong Kong has the ability to take the lead in carbon trading within Asia. The Government has demonstrated a willingness to commit resources to reducing emissions, but has so far followed traditional approaches that do not take full advantage of Hong Kong's particular strengths. Amongst some of the world's best-known brands are companies with deep commitments to sustainable sourcing. It is commercially attractive for many companies to offer customers sustainably sourced goods and services. In so doing, these companies often need a way to measure and offset the carbon emissions in the electricity that they consume.

Just as not every company wants to enter the power business directly due to the importance on focusing on core competencies and recognising realistic constraints, Hong Kong can't reasonably expect to develop the same proportion of renewable energy in Hong Kong as might be expected in New Zealand or Norway or even in the United States or China. Recognising differences leads to strategies to optimise those differences for the greater good. Trading remains one of the best ways to bridge the gap.

Yet, so far, it has been a Hong Kong utility, not the government, that has championed the idea of selling carbon credits directly (without an intermediary) over the internet to customers and businesses from renewable energy projects developed elsewhere in Asia. For such mechanisms to work, people must appreciate that they add value, that they support investments that would not otherwise get made, that they make the overall renewable energy sector in Asia more active and exciting to investors and developers, and that they make it easier for multi-nationals to credibly source and financially support green energy to underpin the goods and services they produce and sell. Ultimately, such mechanisms need government support, validation, and promotion.

6 World Bank. Retrieved from <http://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS?locations=HK-CN-SG> (accessed 23 January, 2017). R&D covers basic research, applied research, and experimental development; such statistics can enable international comparisons.

7 Hong Kong Environment Bureau (2013) *A Clean Air Plan for Hong Kong*. Retrieved from http://www.enb.gov.hk/en/files/New_Air_Plan_en.pdf (accessed 23 January, 2017)

Improving environmental outcomes is about supporting mechanisms that deliver options, not just optics.

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Other possible financial measures include well-designed feed-in tariffs – perhaps ones that incorporate tradeable offsets as a source of value so as to alleviate some of the financial burden for renewables support that would otherwise fall on local electricity consumers. After all, the trick to a good feed-in tariff is not that it merely supports renewable energy project development, but that it does so in a way that drives further innovation in the sector.

Improving environmental outcomes isn't just about finding the technological silver-bullet of abundant, scalable and affordable green energy. It is also about reducing emissions through increased efficiency in conventional power generation, promoting more efficient ways to use energy, identifying and valuing externalities appropriately, and optimising access to, and use of, all available energy resources.

As and when Hong Kong can contribute to answering these questions, then it can rightly say that it is contributing materially and not just optically to a zero carbon future. Hong Kong has an enduring and unique opportunity to lead by example. The government's recent efforts are moving in the right direction. But it's just a start.

About the Author

Mike Thomas has advised energy sector stakeholders on sensitive regulatory, commercial, and strategic matters for over 25 years. He is an expert in the rigorous analysis of energy sector decisions including: how or whether to regulate; how and when to rely on market forces; and what value to place on opportunities and risks. Prior to co-founding The Lantau Group in 2010, he headed the Asia Pacific Energy & Environment practice of a global consulting firm. Mike has an MPP from Harvard Kennedy School and a BA in economics from Carleton College.