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Response to the Public Engagement on Hong Kong's on a long-term decarbonisation strategy for Hong Kong

General information

- Submission made by: J Robert Gibson as an individual
- My age: Above 60 years old
- Do I own commercial/industrial property: YES

Context for this response

I was part of the team which worked on the Hong Kong 2050 is NOW response which Civic Exchange's submitted on 13th September. I'm writing now to elaborate on my personal view of the most important actions the Government can take to decarbonize Hong Kong. I support the other points in Civic Exchange's response but will not duplicate them here.

Several of the more important responses do not fit under the detailed questions and so are given as answers to Question 10.

Energy and Electricity (Q1 to Q3)

Question 1

Carbon emissions by the current generation have serious implications on our future generations - extreme weather, flooding, etc. Decarbonisation is an inter-generation challenge. The key way to reduce carbon emissions is to allocate resources to gradually phase out fossil fuel. Do you support this direction?

■ Yes ☐ No ☐ No comment

While I have replied "Yes" the word 'gradual' is misleading as, per scientific advice[1], it is well justified to aim to limit temperature increase to 1.5C, an objective which requires halving global emissions by 2030 and achieve Net Zero carbon dioxide emissions by 2050. This is a very substantial change which will require urgent, continuous, substantive action. It may require retiring some assets before the end of their normal economic life.

[1] The Oct 2018 IPCC special report on Global Warming of 1.5®C www.ipcc.ch/sr15/

Question 2

How would you rank the importance of different considerations (reliability, security and availability, affordability, and environmental performance and response to climate change) when considering the long-term fuel mix for Hong Kong? (please rank the following in order of importance: 1 – most important; 4 – least important)
-- Reliability
-- Security and availability
-- Affordability
-- Environmental Performance and response to Climate Change

This is not a meaningful question for several reasons. First, the terms are not sufficiently clearly defined. More importantly, all four considerations are important. Their relative importance at any point in time depends on the current level of performance at that point in time.

I recommend the following policies for Hong Kong regarding the electrical power generation sector:

Generating renewable energy in Hong Kong

The Government as previously noted the potential for generating renewable energy in Hong Kong as being 3 to 4%. I suggest:

1. A full assessment should be carried out of the potential to generate energy from renewable sources in Hong Kong together with the reasons why some sources are not currently economic or are ruled out for other reasons such as preserving natural beauty.
2. This assessment serves as a basis for determining how best to increase the amount of renewable energy generated in Hong kong.
3. The assessment be updated every five years.

Importing renewable energy from Mainland China

Government and local electricity companies should explore energy collaboration opportunities in China, in particular, Southern China, by playing the role of an investor in utility projects. Joint venture investment on renewable energy generation project may allow Hong Kong to access low carbon electricity from renewable sources in Mainland China. If this is done, local electricity companies will participate in designing, building, operating and managing the facilities with other investors ensuring reliability and quality of supply. In addition, the Hong Kong Government should play a more active role to liaise the discussion between local electricity companies and city governments in Southern China.

Importing more nuclear energy from Mainland China

Daya Bay has supplied Hong Kong with about 25% of its electricity in a safe, low pollution, low cost, reliable manner for over 20 years. Hong Kong should explore the potential for increasing nuclear energy imports from Mainland China.

Further data is required for making decisions. The consultation notes that by 2025 the % of Hong Kong's electricity which can come from low carbon Mainland sources can be increased from 25% to 35%. It does not however provide information on how this low-carbon electricity might be obtained. The Hong Kong Government's 2010 consultation proposed increasing the share of Hong Kong electricity coming from nuclear from 25% to 50%. Discussion of this proposal understandably stopped after the Fukushima accident. Mainland China however, after carrying out a detailed nuclear safety

assessment, is going ahead with building a substantial number of nuclear power stations. Some of these are being built in Guangdong Province and CLP has a minority share in one of these. Such ownership provides additional transparency and hence comfort on the governance of these stations. Hong Kong should commission a study immediately to assess safety standards and risks with a view towards making a decision about the potential for increasing the share of Nuclear energy imported from China into its energy mix.

Natural Gas with Carbon Capture and Storage (CCS)

Natural gas plants reduce emissions relative to coal but, without Carbon Capture and Storage (CCS), lock around 0.4kg/kWhr emissions and thus do not achieve net zero carbon by mid-century. Rather, gas-fired plants need to be fitted with CCS technologies in order to reach near-zero emissions. However, issues which need to be resolved before Hong Kong commits to Gas with CCS include:

- Availability of geological storage: Guangdong Province has identified very substantial saline aquifers about 100km offshore Hong Kong but there would need to be an agreement with Mainland China for Hong Kong to use this storage.
- Confirmation from large scale pilots elsewhere in the world that CCS is has a sufficiently high CO_2 capture rate at an acceptable total, including transport, cost. As a small territory, Hong Kong is not in a position to develop such pilots. Rather it can position itself to be a 'fast follower' once the technology has been developed elsewhere.

Action to match supply and demand for electricity

If, as I recommend, a much higher percentage of Hong Kong's electricity supply comes from nuclear and renewables, then the ability to adjust supply to meet demand will reduce substantially. Other ways of matching demand and supply of electricity are:

- **Storage.** This is needed when electricity supply exceeds demand. CLP already runs a pumped water facility in Shenzhen. There will presumably need to be further such facilities. Hong Kong should also monitor technology for improving storage. Options include batteries and converting electricity to/from hydrogen.
- **Demand management**- Dis-incentivizing electricity usage when demand is close to exceeding supply. Options include:
  - Introducing a more expensive tariff for guaranteed power at all times and a cheaper tariff for accounts where the electricity utility can restrict supply – e.g. by turning off air conditioners when supply cannot meet total demand.
  - Peak-load pricing for electricity could be higher than at times of low load.

I note CLP has started a pilot project on demand response. The utilities should be required to follow-up on such pilot projects and study how best to combine demand response with variable renewable energy and grid storage for future balancing of supply and demand.

Question 3

Do you support the measures mentioned in the preamble for deep decarbonisation with a view to complying with the target of the Paris Agreement? Such measures include adopting a low-carbon lifestyle, intensifying energy saving efforts, and increasing the proportion of zero carbon energy in our fuel mix through closer regional cooperation, etc.

■ Yes ☐ No ☐ No Comment

If you support the measures mentioned, which one should be prioritised**?** (Please take one that applies)

☐ Adopting a low-carbon lifestyle

☐ Intensifying energy saving efforts

■ Increasing the proportion of zero carbon energy in our fuel mix through closer regional cooperation

All the above actions are necessary. I note that:

- Decarbonizing electricity has the biggest impact on emissions reported to the UNFCCC.
- Carbon emissions embodied in Hong Kong's imports of food, clothing, machinery and its purchase of international air travel together almost certainly substantially exceed the Hong Kong emissions reported to the UNFCCC.

Reducing my own emissions (Q4)

Question 4 What measures would you adopt to reduce your carbon emissions? (Please tick ONE that applies)

NOTE: I've answered this based on my behaviour in recent months rather than what I think I may/should do in the future.

For Individuals

(only applicable to respondents who answer this views collection form in their personal capacity)

		Very likely	Likely	Unlikely	Very Unlikely
Clothing / Wsaste Reduction	(i) Buy fewer clothes	■	☐	☐	☐
	(ii) Buy products with minimal packaging	☐	■	☐	☐
	(iii) Practise waste reduction at source and clean recycling	☐	■	☐	☐
Eating	(iv) Avoid purchasing/ordering more food than needed	■	☐	☐	☐
	(v) Buy local / neighbouring areas' food as far as practicable which consumes less energy arising from transportation	☐	☐	■	☐
	(vi) Eat more vegetables and fruits and less meat	☐	■	☐	☐
	(vii) Avoid buying plastic bottled drinks, etc. and bring your own bottle	☐	☐	■	☐
Accommodation	(viii) Purchase energy-efficient electrical appliances (e.g. those with Grade 1 energy labels), such as inverter type air conditioners and LED light bulbs, etc.	■	☐	☐	☐
	(ix) Use natural ventilation/fans instead of air conditioners as far as possible	■	☐	☐	☐
	(x) Maintain air-conditioned average room temperature between 24 °C and 26 °C or above in summer	■	☐	☐	☐
	(xi) Switch off power source to the electrical appliances that will not be in use to avoid energy consumption in standby mode	■	☐	☐	☐
	(xii) Turn off the lights when not in use	■	☐	☐	☐
	(xiii) Install a low-flow shower-head and take shorter showers	■	☐	☐	☐
	(xiv) Wait until there is a full laundry load before using the washing machine	■	☐	☐	☐
Commuting	(xv) Use public transportation as far as possible	■	☐	☐	☐
	(xvi) Walk for short-distance commuting as far as possible	■	☐	☐	☐
	(xvii) Minimise outbound travel via air and cruise trips. Enjoy our local / neighbouring areas' recreational facilities as far as possible, such as country parks, etc.	☐	☐	■	☐
Review Progress	(xviii) Use Environment Bureau's Low-carbon Living Calculator from time to time to assess personal carbon footprint and identify room for carbon reduction	☐	☐	☐	■
Others	(xix) Please specify:	☐	☐	☐	☐

Building Energy Efficiency (Q5 & 6)

Question 5

Beyond measures listed in question 4, what could you or your sector do to reduce energy consumption in new and existing buildings in Hong Kong? what support measures and information may be useful to further promote energy efficiency in new and existing buildings?

See answer to Question 6.

Question 6

The Government has rolled out various measures to promote green buildings. To help us achieve the decarbonisation target, is there a need for the Government to do more to promote energy efficiency in new and existing buildings? If yes, what further policy instruments and incentives should be implemented?

■ There is a need (Please specify the policy instruments and incentives that should be implemented)

☐ No need

Empower the HKGBC to add a 'BEAM+ Energy Star' measure to its existing ratings

Commercial buildings account for the majority of electricity used in Hong Kong so action to strongly incentivize their energy efficiency is important. Based on studies and experience elsewhere in the world the most effective action to manage down this electricity consumption is to introduce and incentivize a measure for publicizing actual building energy efficiency[2]. I therefore recommend empowering and requiring the HKGBC to add a 'BEAM+ Energy Star' measure to its existing ratings. This new rating would be additional to current BEAM+ ratings and only cover building energy efficiency. (NB: Under BEAM properties get extra points for factors such as bicycle parking spaces). Once the BEAM+ Energy Star scheme is well established:

- The 'Energy Star' rating will be calculated from the buildings energy consumption, size and hours of operation with adjustments for special equipment, such as large computers, used in the building.
- An 'Energy Star' rating is only valid for 12 months so each building must be assessed every 12-month period based on its actual consumption for the last 12 months.

Note:

- An 'Energy Star' rating is used so it is easily understandable by the public.
- The cost of running the scheme will be low if the HKGBC trains appropriate independent professionals and then certifies them as able to given BEAM+ Energy Star ratings.
- All ratings, with supporting information, are sent electronically to the HKGBC which randomly checks a sample to assure quality and consistency.
- After a phase in period the ratings for large buildings should be published on the HKGBC website. to provide transparency on the energy performance of buildings.
- Tax incentives for achieving certain BEAM+ Energy Star levels should be introduced once the scheme has been running for some years and developed both substantial coverage and good public trust in its ratings.

[2] Studies highlighting the importance of measuring and publishing actual building energy consumption

1) WBCSD Energy Efficiency in Buildings. Levers for change on page 31 of http://docs.wbcsd.org/2007/10/EEB_FactsTrends-Summary.pdf
2) HKGBC HK3030 on the crucial role of benchmarking: www2.hkgbc.org.hk/upload/HK3030/Home/roadmap_31OCT2014_preview.pdf
3) NABERS: www.nabers.gov.au/about/what-nabers

Mobility (Q7 & 8)

Question 7

What are your views on promoting the wider use of green and innovative transport technologies?

The Government should consider the relative merit of green and innovative transport technologies within the commonly used approach of 'Avoid, Shift, Improve' with the objective of meeting mobility needs while reducing CO_2 emissions from transport. Please refer to my answer to Q10 for further comments on this.

The number of private vehicles on the road in Hong Kong has been constantly increasing, with a 14% increase in car registrations from 2014 to 2018. In April 2019, there were a total of 621,648 registered private vehicles in Hong Kong. This high number of private cars is undesirable for three reasons:

1. They produce higher CO_2 emissions by passenger-kilometre than other transport modes.
2. They use more road than other transport modes. This inefficient use of road space leads to greater traffic congestion causing an overall increase in CO_2 emissions from transport.
3. Hong Kong's cars have low utilisation rates so have high CO_2 emissions per kilometre when this is calculated on a 'life cycle analysis' basis. That is taking the total emissions from manufacturing and using the cars and dividing by the distance they are used for in their lives. While the CO_2 emissions during manufacture do not occur in Hong Kong they add to the load on planet Earth which activity in Hong Kong causes.

The most effective way to control the growth in private cars is to continuously increase the public transportation ridership and reduce the desirability of owning a car.

Review and restructure the private vehicle licence fee structure

The current private vehicle licence fee depends on the cylinder capacity of the engine or gross vehicle weight, for instance, larger cylinder capacity will cost the owner more for licence renewal. The polluter pays principle should be introduced into the vehicle licence fee system, in particular, the vehicular CO_2 emission should be taken for consideration. The licence fee structure should include a base tax and a CO_2 tax. Using Germany's experience as an example, the base tax is €2 per 100cc (petrol) and €9.50 per 100cc (diesel). The CO_2 tax is linear at €2 per g/km emitted above 95 g/km and vehicles while CO_2 emissions below 95 g/km are exempted from tax.

Hong Kong can maintain the current license fee as a base tax, and establish a CO_2 tax on top of it. The CO_2 tax can be waived for vehicles emitting below 95 g/km. The CO_2 waiver standard should be reviewed every three years with vehicles which don't meet the top 20% best performance in the reviewing year required to pay the CO_2 tax in future years.

Motivate a shift from private car ownership to use of public transport and walking supplemented by car fleets or ride-sharing services

The Government should implement policies that discourage private car ownerships and encourage walkability. Parking space regulation, limits on new car registrations, electronic road pricing, right of way for public transport, prioritizing planning for walkability and cycling, etc. are examples of ideas implemented successfully in other jurisdictions.

The Government should consider promoting EV based car-sharing transport or autonomous shuttles to supplement public transport. Car-sharing should, however, only be used when the needs of passengers cannot be fulfilled by public transportation. For example, families with kids, the elderly, and pregnant women are

potential users of car-sharing because it is more difficult for them to use public transport. Other potential users are those living in remote areas with only limited access to public transport.

Hydrogen vehicles (H_2Vs)

Currently, a significant volume of EVs are being produced and used globally but only a small number of H_2Vs. H_2Vs, however, could be a key future technology to consider when developing long-term policies. Factors in favour of H_2Vs include:

- Lighter weight for a given range making them suitable for Heavy Duty Vehicles (HDVs) such as buses and refuse collection vehicles which are payload constrained.
- Faster refuelling times making them suitable for vehicles which operate for long periods. These include many HDVs, taxies and minibuses.
- Substantially less use of difficult to recycle metals. (EVs often have lithium and cadmium in their batteries.)

Reasons, beside the above advantages to believe H_2Vs may well have a significant future role include:

- The likelihood that international shipping will switch to H_2 making it viable for Hong Kong to develop H_2 infrastructure.
- The IEA's recent report on the hydrogen economy[3].

Focus on making zero emission fuels economic for taxies and minibuses

It should be high priority to convert Hong Kong taxies and minibuses to zero emission fuels, such as EV or H_2V. Reasons:

1. The average Hong Kong taxi does more than 14 times the mileage of the average Hong Kong private car.
2. Hong Kong taxies and many of its minibuses use LPG which has high CO_2 emissions.

The Government should, therefore, holistically approach on how to efficiently change from LPG to zero emission taxies and minibuses. For EV taxies the time taken to charge each taxi may mean the total fleet size must be increased with drivers being able to leave a taxi for charging and pick a charged taxi part way through their shift. The solution may include;

- Provide space for taxi fleet operators to have depots where they recharge many taxies at the same time;
- Adjusting first and annual registration taxes on taxies to make the change economic for taxi fleet operators.

The issues and solutions for mini-buses are similar to taxies. The green mini-buses being on fixed routes may make it easier to provide an economic solution.

As the Government has the power to regulate taxi and mini bus fuel, I suggested that it actively searches for new technology, carries out pilot test and setts a robust roadmap for converting these vehicles from internal combustion engines to zero emission fuels. It can then consider changing the operational model of taxies and initiate dialogue with related guilds and big syndicates.

[3] The IEA June 2019 report on the hydrogen economy: www.iea.org/publications/reports/thefutureofhydrogen/

Question 8

There are calls for a ban on fossil fuel powered (e.g. petrol and diesel) vehicles around the world. Some countries have announced that they will ban the sale of fossil fuel vehicles from 2030 onwards. What are your views on banning fossil fuel vehicles in Hong Kong? What other measures would you suggest to further reduce our transport-related carbon emissions?

Yes, Hong Kong should ban fossil fuel powered vehicles but the timing of the ban must take account of technological developments. For example, banning fossil fuel private cars can happen sooner than banning heavy duty vehicles.

Set a more proactive target near-term improvement and long-term banning of commercial vehicles powered by traditional fuels

To ensure the timely replacement of diesel commercial vehicles and continuous improvement of air quality, current government policy requires Pre-Euro, Euro1, Euro2 and Euro3 diesel commercial vehicles to be phased out according to the first registration date of the vehicles. The Government has set a 15-year retirement period for diesel commercial vehicles registered on or after 1 February 2014. Eligible owners can apply for special grants to buy cleaner vehicles. This policy has been beneficial but will need to be adjusted.

The Government should pay close attention to the development of EV and H_2V technology together with related software and hardware infrastructure. With the emergence of new technologies, it should consider tightening restrictions on lower-standard diesel vehicles, for example, by including the Euro4 and Euro5 vehicles.

Improve charging facilities and establish a coverage target

In addition to the property tax concessions, the Government should allocate resources towards enhancing the performance of EV chargers and increasing the number of chargers to meet forecast demand. To the extent benefit/cost justified it should:

- Arrange charger access to many more public parking meter and government car park berths.
- Mandate private housing estates to provide chargers. In existing buildings, it might subsidize real estate owners to add chargers in car parks. For new buildings, it can require provision of chargers in car parks by amending the Buildings (Planning) Regulation.

Other measures:

To further reduce our transport-related carbon emissions, I suggest the following policies;

- **Establishing congestion pricing in central district immediately:** For over 30 years, the Government has suggested congestion pricing in the central business district to reduce the number of private vehicles on the road. It should take the lead in using congestion pricing to control the growth of private cars, learning from experiences in Singapore, Sweden and the United Kingdom.
- **Incorporate a mandatory fleet-wide average carbon dioxide standard into APCO or relevant legislation:** CO_2 is the major contributor to global warming so the Government should include CO_2 emissions of new vehicles in the Air Pollution Control Ordinance (APCO). For this it can refer to standards set by the EU Commission and set a schedule for reduction in average CO_2 emissions with changes every, say, five years towards zero emissions from motor vehicles. As part of achieving this goal, the Government should consider the EU fleet-wide average emissions target by requiring that a percentage of each importer's vehicle fleet to be below the 95 g CO_2/km threshold. The policy should include flexibility to change targets based on results of annual reviews.

Lifestyle (Q9)

Question 9

What measures would you suggest to (a) the Government / the public sector and (b) private organisations that would motivate you as an individual to practice low-carbon lifestyle?

Government efforts to lower lifestyle carbon footprints

Reasons why this is an issue of prime importance.

1. The indoor temperature people accustom themselves to impacts space conditioning and hence Hong Kong's Scope 1 emissions.
2. As noted in my answer to Question 3, impacts CO_2 emissions embodied in Hong Kong's imports of food, clothing, machinery and its purchase of international air travel. These items, taken together, almost certainly substantially exceed the Hong Kong emissions reported to the UN.

The role of government is crucial in the transition to low carbon lifestyles, as it is the only stakeholder capable of coordinating and overseeing a society-wide response. The Hong Kong Government should set more specific carbon emissions reduction targets to guide progress and inform future decision-making. Specifically it should:

1. Use behavioural science to inform policy-making. Understanding the motivations of individuals will help in implementing policies to guide consumers into making more sustainable choices.
2. Target high carbon emission activity with multi-pronged strategy covering information provision, labelling, feedback, and action plans.
3. Eliminate or restrict high-carbon choices from the market through regulations and taxation (including on taxes on embodied carbon).

Measures that would motivate individuals to lower carbon emissions caused by their energy use in buildings

If, as recommended in our answer on page 11 to Question 7, a HK Beam + Energy Star rating is introduced it will make the energy performance of office buildings as visible as hotel 'Star' ratings make the quality of hotels. This can drive company decisions on which building to rent space in and hence building owners attention to energy efficiency.

Home energy consumption can be reduced by increased awareness from the use of smart thermostats, localised cooling devices, smart lighting and smart plugs, accompanied by promotion efforts, and assisted by financial incentives.

Building owners should be encouraged to actively engage neighbourhood and community efforts to increase motivation for energy savings.

Businesses can enhance social responsibility by influencing overall lifestyle patterns and supply chains through better design of their products. Chambers of Commerce should encourage their members to use green procurement strategies and adjust their business models towards a more circular economy approach.

Other Recommendations (Q10)

Question 10

Apart from all the decarbonisation measures mentioned in the PE document, do you have any other suggestions to help Hong Kong reduce carbon emissions?

Q10 point 1: Scope of carbon emissions on which Hong Kong reports

The Hong Kong SAR Government's past practice has been to report only on its Scope 1 emissions. I recommend it seeks the PRC Central Governments agreement to change to reporting on its Scope 1 plus Scope 2 emissions. Reasons for this include:

1. By reporting on, and targeting, Scope 1 + 2 emissions the Hong Kong SAR will avoid any bureaucratic tendency to reduce reported emissions by having electricity generated in Mainland China rather than Hong Kong.
2. An increasing number of provinces and cities in Mainland China are reporting on Scope 1 + 2. Hong Kong adopting the same basis facilitates China's UNFCCC reporting of Hong Kong, Macau and Mainland numbers.

Besides its reporting of Scope 1 + 2 emissions, the Hong Kong SAR should have a programme for estimating the main Scope 3 emissions of Hong Kong residents. These include imported food, manufactured products and travel outside Hong Kong. These footprints will need to be reduced as humanity moves to global decarbonisation. Having a programme to understand them will help the Government plan for the impacts of this reduction.

Q10 point 2: Establishing robust governance structure

It is likely that action on reducing carbon emissions and adapting to climate change will need to continue for at least 100 years and will have a major impact on the structure of Hong Kong's economy. Hong Kong will, therefore, need governance mechanisms which enable it to make good, timely decisions notwithstanding short-term political pressures. The Government should, therefore, review of governance mechanisms used in other countries and, as appropriate, improve its governance mechanisms.

Q10 point 3: Setting Carbon reduction target for 2050

Referring to the Public Engagement document:

- Both the Executive Summary on page 5 and Para 1.7 on page 14 note the Paris Agreement's statement that Net Zero Carbon Emissions are required by 2100 to stabilize temperatures at a 2C increase. Further, that the IPCC's advice that Net Zero is needed by 2050 to stabilize temperatures at a 1.5C increase.
- This is 'Net Zero imperative' is not, however, mentioned on page 31 where the options of 60%, 80% or 100% (net zero carbon emissions) targets for 2050 are detailed. There is therefore a risk that some people will chose the 60% or 80% reduction targets without appreciating their implications.

I recommend when setting a target the Government clearly communicates the following:

- The radiation imbalance making the world's climate worse will continue to increase until humanity achieves Net Zero greenhouse gas (GHG) emissions.
- It will take many years for the world's climate and sea levels to stabilize at the increased level of GHG in the atmosphere caused prior to achieving Net Zero GHG emissions. This further deterioration is due to the many years it takes to warm up oceans and melt ice to match the new GHG level.

- How rapidly humanity gets to Net Zero emissions will determine how high the temperature and sea levels rise. And this is not just about the date Net Zero is achieved it is about the profile of the emissions reduction.

Further, when setting Hong Kong's target for 2050 the Government should recognize:

- The IPCC's advice on the net benefit of limiting temperature increases to 1.5C rather than 2.0C.
- The different development stages of countries around the world makes it both equitable and efficient for the global average reduction in emissions to comprise some less developed countries having small reductions or, in some cases increases, while advanced countries have greater than average reductions.

The implication being that, as and advanced economy Asia's World City, Hong Kong should target Net Zero carbon by 2050.

Q10 point 4: Putting a price on carbon emissions

In line with Hong Kong's tradition of 'light touch' government it should study the opportunities for decarbonizing through putting a price on carbon emissions. Reasons for this include:

1. A carbon price allows best solutions to be found through market mechanisms rather than detailed regulations. This can drive down cost as entrepreneurs find solutions which were not visible to regulators. Further, markets can react rapidly whereas it can take years of work and political debate to change regulations.
2. Having a carbon price rather than regulation simplifies the role of government.
3. Studies of action needed to reduce global CO_2 emissions[4] suggest technology developments will makes a significant contribution from 'Direct Air Capture' (DAC) of CO_2 part of the lowest cost way of achieving Net Zero. Further that the cost of running DAC will determine the price territories with net CO_2 emissions will have to pay for these emissions to be removed from the atmosphere. Hong Kong having a carbon price would facilitate:
    a. It eventually paying for its residual emissions to be removed by DAC operators in other territories.
    b. Pricing future carbon removal costs into decisions on buying long-life assets and thus creating a more efficient economy.

Q10 point 5: Using 'Avoid, Shift, Improve' thinking to manage down CO_2 emissions from mobility

As note in our answer to question 7, the Government should consider the relative merits of green and innovative transport technologies within the commonly used approach of 'Avoid, Shift, Improve.' to both improve mobility and reduce CO_2 emissions from transport. In brief:

- **Avoid** stands for 'Avoiding Journeys'. For example, better town planning can reduce travel from home to work or school.
- **Shift** covers 'Shifting' from more CO_2 emissions intensive to less CO_2 emissions intensive transport modes. For example, from private cars to buses; or, from buses to the MTR.
- **Improve** covers 'Improving' a given mode of transport. For example, reducing CO_2 emissions by switching from petrol to electric vehicles.

[4] Direct air capture of CO_2 and climate stabilization: A model based assessment Chen Chen and Massimo Tavoni https://link.springer.com/article/10.1007/s10584-013-0714-7

Examples of how 'Avoid, Shift, Improve.' thinking helps reduce CO_2 emissions is Town Planning:

- Mixed use districts allow people to live close to their work and children to walk to school.
- Expanding the MTR network with dense property developments provided in the 500 meters closest to MTR stations allows people to move about though a combination of walking and MTR. This is aided by careful planning for attractive walking, and where appropriate cycling, paths from MTR stations to residential on work buildings.

This action both avoids the need for journeys and increases the percentage of travel which is on low-carbon transport modes.

Q10 point 6: International travel

More than half the hydrocarbons imported into Hong Kong are used for bunkers for international shipping and aviation. This is one indication of how critically dependent Hong Kong's economy is on these sectors. Hong Kong should, therefore, give priority to participating in work to decarbonize them. To the extent Hong Kong has jurisdiction under one country two systems specific action includes:

1. Assist in the establishment of a Monitoring, Reporting and Verification (MRV) system for international shipping and aviation
   A strong MRV system is a precondition and foundation for all carbon dioxide emission reduction activities, including understanding current and historical trends, forecasting future emissions, setting emission reduction targets, formulating action plans, and tracking performances. The International Marine Organization (IMO) launched mandatory MRV scheme for international shipping in January 2018 and January 2019 respectively[5].

2. Participate in the R, D & D for low carbon fuels
   In the longer-term, low carbon fuels or paying for Direct Air Capture will be crucial to international shipping and aviation becoming Net Zero carbon. Given, as noted above, the importance of these sectors to its economy, Hong Kong should participate in the R, D & D for such fuels. For example, it should (a) prioritize marine electrical shore power systems; and, (b) pay close attention to how it would refuel ships that use hydrogen or ammonia as fuel.

[5] www.dnvgl.com/maritime/insights/topics/EU-MRV-and-IMO-DCS/index.html