

617B00031

Written Submission on Government's Consultation Document *"Future Fuel Mix for Electricity Generation"*

17 June 2014

TABLE OF CONTENTS

1.	Intr	oduction	2
	1.1	The Consultation Document	2
	1.2	General comments	2
	1.3	Acknowledgements	3
2.	Com	ments on the Scope of the Consultation Document	3
	2.1	Introduction	3
	2.2	Management of local electricity demand	4
	2.3	Future development of Hong Kong's electricity generation and distribution market	5
	2.4	Determining Hong Kong's contribution to reducing global carbon emissions	5
	2.5	Potential of low-carbon energy options	6
	2.6	Sources and use of natural gas in Hong Kong	7
	2.7	Economic life of current electricity generating units	8
3.	Com	ments on the Consultation Document's Guiding Energy Policy Objectives	9
	3.1	Introduction	9
	3.2	Reliability	9
	3.3	Affordability	10
	3.4	Environmental performance	11
4.	Eval	uating the Fuel Mix Options	12
	4.1	Option 1: Grid purchase	12
	4.2	Option 2: Local production	14
	4.3	Other low-carbon options: renewables, CCS and nuclear power	14
5.	Con	clusions	15



1. INTRODUCTION

1.1 The Consultation Document

- 1.1.1 The Environment Bureau of the Hong Kong Special Administrative Region Government (hereinafter, the Government) launched a consultation document entitled *Future Fuel Mix for Electricity Generation*¹ (the Consultation Document) on 19 March 2014. The Consultation Document provides an overview of the present fuel mix for Hong Kong's electricity generation, and considers how this mix should change over the next ten years, in light of the four energy policy objectives of safety, reliability, affordability and environmental performance. It also considers implications of the fuel mix choice on the post-2018 electricity market, diversification of energy sources, and flexibility in scaling up future supply. The consultation lasted for three months until 18 June 2014.
- 1.1.2 The Consultation Document also puts forward two fuel mix options (see Table 1 below) for public view and discussion. It is noted that the Government has taken an open position on the two options.

		IMPORT		ΝΔΤΠΡΔΙ	COAL
	FUEL MIX	Nuclear	Grid	GAS	(& RE)
		(DBNPS)	purchase	073	
E	xisting (2012)	20%	-	22%	55%
	Importing more electricity through purchase from the mainland power grid	20%	30%		
Option 1		Total:		40%	10%
		50%			
	Using more natural				
Option 2	gas for local	20%	-	60%	20%
	generation				

Table 1: Current and proposed fuel mix options²

1.2 General comments

1.2.1 Civic Exchange welcomes the Government's open approach in deliberating the important issue of future energy policy. This is conducive to developing evidence-based policies which are appropriate for Hong Kong's long-term future.

¹ Environment Bureau, *Future Fuel Mix for Electricity Generation: Consultation Document*, March 2014, Hong Kong: HKSAR Government,

http://www.enb.gov.hk/sites/default/files/en/node2605/Consultation%20Document.pdf, (accessed 20 May 2014).

² Ibid.



- 1.2.2 Civic Exchange also appreciates the Government's effort in keeping the Consultation Document short and simple, in order to reach out to a wider audience in the community. The downside of this approach, however, is the lack of detail, assumptions and explanations for the technically-savvy and expert readers. To this end, Civic Exchange suggests that a separate 'technical annex' could be attached to the Consultation Document with greater detail for those who wish to go deeper into the issues, without overloading the lay readers with indigestible information.³ This approach should be seriously considered for future public consultation documents published by the Government.
- In the following sections, Civic Exchange's comments will be organised in 1.2.3 terms of the scope of the Consultation Document, definitions of the energy policy objectives, and different fuel mix options.

1.3 Acknowledgements

Civic Exchange is grateful to Bill Barron, Michael Edesess, Freda Fung, Robert 1.3.1 Gibson, Daphne Mah, Pamela Mar, Mike Thomas, CW Tso, and Xu Yuan, who shared with us over the last couple of months their insight into Hong Kong's future energy policy. Civic Exchange also drew from the views contributed by various speakers and participants during an open forum that we organised on 31 May 2014.⁴

2. COMMENTS ON THE SCOPE OF THE CONSULTATION DOCUMENT

2.1 Introduction

- 2.1.1 The Consultation Document put its main focus on future fuel mix for electricity generation in Hong Kong. This is a complex but important topic that warrants a standalone consultation. However, it is also just one part of a large, interrelated set of issues that would determine Hong Kong's long-term energy policy. As such, a consultation that only emphasises fuel mix for electricity generation was deemed too narrow in scope by many people.
- 2.1.2 In response to these comments, the Government explained, during various recent open events, that other consultation documents will follow in the next 12 months on related issues, such as energy efficiency, the opening of the

³ An example of this is the recent European Union publication of a 'Communication Document' on energy security, accompanied by a longer 'Commission Staff Working Document'. For EU Energy Security publications, see European Commission, Memo/14/379: Questions and answers on security of energy supply in the EU, 28 May 2014, European Union.

http://europa.eu/rapid/press-release_MEMO-14-379_en.htm (accessed 17 June 2014).

⁴ Civic Exchange organised an energy forum entitled A Holistic Approach to Building a Sustainable Energy Future for Hong Kong on 31 May 2014 on the fuel mix consultation. For the event programme and report, please see Civic Exchange, [Energy Forum 18] A Holistic Approach to Building a Sustainable Energy Future for Hong Kong – Event Summary Report, June 2014, Civic Exchange,



electricity market, and climate change strategy. When these new consultation documents become available in the public domain, Civic Exchange will re-visit our response based on the current Consultation Document and our views on future policy direction.

- 2.1.3 Nevertheless, for the benefit of an informed, ongoing discussion before any new information becomes available, Civic Exchange recommends the following key issues, which are omitted or insufficiently covered by the Consultation Document, be duly addressed:
 - (a) Management of local electricity demand;
 - (b) Future development of Hong Kong's electricity generation and distribution market;
 - (c) Determining Hong Kong's contribution to reducing global carbon emissions;
 - (d) Potential of low-carbon energy options;
 - (e) Sources and use of natural gas in Hong Kong; and
 - (f) Economic life of the current electricity generating units.

2.2 Management of local electricity demand

- 2.2.1 Action to improve energy efficiency and reduce energy consumption is a key factor in planning Hong Kong's future need for centrally generated electricity. While the Consultation Document refers to action on demand side measures (paragraph 2.15), it also assumes an average 1 to 2 per cent per annum 'business-as-usual' growth in Hong Kong's electricity consumption (paragraph 2.6). Civic Exchange presumes this is the annual average growth rate without taking into account any improvement in energy efficiency. Of all the issues not covered by the Consultation Document, this planning for no improvement in energy efficiency is the one most people feel strongly against.
- 2.2.2 The Government's review of demand for centrally generated electricity should also consider the extent to which electricity may be generated by distributed sources, such as gas 'Tri-Gen' units and solar photovoltaics (PV). The Consultation Document's assertion that renewable energy will contribute little of Hong Kong's energy needs by 2023 (paragraph 4.5) may be correct, but distributed energy production could become significantly important in the longer term.⁵

⁵ To explore distributed energy production in the longer term, a number of factors have to be considered, such as (a) the availability of distributed natural gas; (b) the pace of technological development; and (c) how electricity fed into the grid should be priced: the current Scheme of Control Agreements require power companies to pay a 'reasonable price' for electricity fed into the grid. This has been interpreted as the cost of fuel saved, a low price which does not make providing power to the grid viable. A higher price would be justified based on the value of savings in carbon emissions and air pollution calculated using a 'shadow' carbon price and a shadow SOx/NOx/Particulates price.



2.2.3 Another consideration is that once the carbon intensity of electricity supply is reduced, decarbonising the economy will require switching other fossil fuel applications to using electricity. Replacing diesel-powered vehicles with electric vehicles and replacing gas with electricity for domestic water heating and cooking are some examples. This will both increase the demand for electricity and alter load profiles.

2.3 Future development of Hong Kong's electricity generation and distribution market

- 2.3.1 The Government has announced it is commencing a review of the future regulatory framework for the electricity market.⁶
- 2.3.2 Civic Exchange emphasises that, among other things, this review should consider the following three areas. First, it should consider additional incentives for the two local power companies, Hongkong Electric Company, Limited (HKE) and CLP Power Hong Kong Limited and Castle Peak Power Company Limited (collectively as CLP), to help consumers improve energy efficiency and take other measures to conserve electricity. A starting point might be to consider setting the return on investment for energy saving projects in a similar way to the return on investment for electricity generating assets.
- 2.3.3 Second, this review should consider the future role of distributed electricity generation in Hong Kong (see paragraph 2.2.2), and the means to remove the barriers and provide incentives for it.
- 2.3.4 Finally, the review should also consider the pros and cons of greater grid connectivity between HKE and CLP, and also with the China Southern Power Grid Co. Limited (CSG), regardless of fuel mix considerations.⁷

2.4 Determining Hong Kong's contribution to reducing global carbon emissions

2.4.1 Civic Exchange argues that in planning for Hong Kong's energy future, it is essential to anticipate the likelihood of eventual limits on allowable carbon emissions.⁸ Hence, minimising future vulnerabilities in this regard is a key to

⁶ Hong Kong SAR Government (2014) *The 2014 Policy Address: Policy Agenda*, p.84, January 2014, Hong Kong: HKSAR Government, http://www.policyaddress.gov.hk/2014/eng/agenda.html, (accessed 17 June 2014).

⁷ As noted in the Document, the benefits of greater grid connectivity include flexibility in load management and meeting the increase in future demand within shorter planning lead times. Another benefit is to reduce the need for HKE and CLP to keep spare capacity. However, against these benefits must be set the costs of the required infrastructure and exposure to risks that can affect Hong Kong through the enhanced connections with CSG. Physical grid infrastructure is only one part of the equation. Other potential impacts include loss of transparency together with the complex implications for changes in operating control, planning standards, reliability protocols, accountabilities, and system dispatch arrangements. Ultimately, increased reliance on interconnection implies a reduction of local control and accountability for Hong Kong's security of supply.

⁸ While it is more appropriate to refer to all the greenhouse gases which contribute to climate change, this written submission adopts the Government's terminology of referring to 'carbon' emissions.



Hong Kong's overall electricity planning including the fuel mix for electricity generation.

- 2.4.2 The three Intergovernmental Panel on Climate Change (IPCC) reports issued in 2013 and 2014 detail the serious climate change and other consequences the current trajectory of carbon emissions will lead to. They note that avoiding dangerous climate change requires around 80per cent of electricity to be generated from carbon-emission-free sources by 2050, and all electricity to be generated from such sources by 2100. Carbon-emission-free sources may include renewable energy, nuclear or carbon capture and storage (CCS).⁹
- 2.4.3 China and other countries are preparing to advise on the contributions they will make towards reducing global carbon emissions. Statements are expected in early 2015, followed by an agreement in December 2015.
- 2.4.4 Civic Exchange presumes that Hong Kong will advise on its contribution at the same time as China. This requires the Government to set goals for Hong Kong's carbon emissions reduction by 2025 or 2030¹⁰ preferably with reference to a 2050 target, as well as confirming its contribution for 2020. These goals may impact decisions on fuel mix for electricity generation. One option for factoring the goals into decision making is to set a 'shadow' carbon price which is used to calculate the cost of carbon emissions and hence choice of the different electricity generation options which the government permits under the Scheme of Control Agreements. Such an exercise should evaluate the sensitivity of plans to possible variations in the shadow price of carbon.

2.5 Potential of low-carbon energy options

- 2.5.1 As noted above, the IPCC advises that 80 per cent of global electricity will need to be carbon-free by 2050 (paragraph 2.4.2). Civic Exchange believes it is reasonable for an advanced economy like Hong Kong to become 100 per cent carbon-free by 2050, while the remaining emissions would come from less developed countries.
- 2.5.2 To achieve this, Hong Kong should evaluate the viability and potential scale of other low-carbon energy options, including solar PV, CCS and nuclear.
- 2.5.3 <u>Large-scale solar PV</u>: there is a lack of clarity as to how Hong Kong's solar resource compares with other countries'. It would be helpful if the actual performance of large solar arrays in Hong Kong, such as the one in the Electrical and Mechanical Services Department (EMSD) Headquarters, the Zero Carbon Building (ZCB) and HKE's Lamma Island station are made readily available. While Hong Kong's annual solar radiation may be relatively low, the viability of solar PV is likely to continue to improve given the advances in PV

⁹ Carbon capture and storage is the process of burning fossil fuel and then capturing the resulting carbon dioxide for underground storage.

¹⁰ The date Hong Kong provides its commitment for carbon emissions reduction will presumably be the same as for China. It is not yet known whether China will opt for 2025 or 2030.



technology, the high cost of gas in Hong Kong, and options to reduce distribution losses by using electricity from solar PV directly.

- 2.5.4 <u>CCS</u>: even with potential advances in solar PV there is likely to be some fossil fuel burning and it will be necessary to capture its carbon emissions and store them underground. Hong Kong has a competitive advantage for capture and storage given its proximity to large offshore saline aquifers. The technology for doing this in a viable manner is still being developed but there is active investigation around the world including a programme in Guangdong Province. This option should therefore be included in Hong Kong's planning so it can be implemented once CCS technology becomes viable.
- 2.5.5 <u>Nuclear</u>: there is considerable discussion of new nuclear power. Concern has been expressed regarding the full life cycle costs of nuclear power, including the cost of handling waste, decommissioning plants and an allowance for the consequences of accidents such as Fukushima. On the other hand, advances in technology and larger scale deployment may substantially bring down costs.

2.6 Sources and use of natural gas in Hong Kong

- 2.6.1 Hong Kong is supplied exclusively from mainland China with gas coming either from the West-East pipeline or from liquefied natural gas (LNG) imports into China. Civic Exchange believes this arrangement puts Hong Kong in a weaker bargaining position than if it had an LNG terminal or substantial access rights to an LNG terminal on the mainland so Hong Kong companies can buy part of their LNG supply from the world market.
- 2.6.2 With the substantial increase in gas usage envisaged in both fuel mix options put forward by the Consultation Document, it is useful to explore if there is a case for Hong Kong to have its own LNG terminal. The main benefit of having a terminal is the flexibility in obtaining the fuel rather than committing to long-term take-or-pay gas contracts.
- 2.6.3 Apart from looking for ways to improve gas security, Civic Exchange encourages the Government to expand the use of natural gas in Hong Kong from power generation to other applications, like domestic water heating and cooking and the transport sector, for the carbon and air pollutant reduction benefits.
- 2.6.4 Currently the Hong Kong & China Gas Company uses naphtha plus natural gas to produce towngas which is piped around Hong Kong. This is a legacy of technology which produced towngas from coal. Other countries which have moved away from coal-derived domestic towngas have upgraded to piping natural gas to consumers.
- 2.6.5 The one-off cost of changing burners in consumer appliances to handle natural gas is probably substantially out-weighed by significant reductions in energy



loss and carbon emissions created in the process of manufacturing towngas.¹¹ Having natural gas piped throughout Hong Kong also facilitates the introduction and promotion of technologies such as Tri-generation and fuel cells.

2.6.6 Such a system would also benefit the promotion of gas-powered vehicles in Hong Kong, which would lead to a reduction in roadside air pollution.

2.7 Economic life of current electricity generating units

- 2.7.1 While a significant portion of Hong Kong's electricity generating assets are coming to the end of their depreciation life, this does not mean they are at the end of their economic life. Accounting prudence normally leads to depreciated lives being shorter than economic lives. It is noted in the Consultation Document that some units may have their life extended (paragraph 2.5) but no detail is given. Extra information is thus required on the remaining safe economic life of the generating units as a basis for deciding when to replace them.
- 2.7.2 Both options proposed by the Consultation Document will burn more gas. They also have coal (and a very small amount of renewables) contributing 10 per cent to 20 per cent of electricity generated, as well as a substantially greater unused capacity which can be brought online over a period of days if other power sources are constrained. Given this, Civic Exchange urges the Government to explore and decide whether Hong Kong should reduce its carbon emissions and local air pollution by replacing its current old, inefficient gas and coal units with the much more efficient units which are now available.¹²
- 2.7.3 If the decision is made to replace the units then the sooner this is done the sooner Hong Kong benefits from improvements in environmental performance. There will also be reductions in fuel costs which may cover the higher capital costs.

¹¹ In 2012, 11.92 kg of CO₂ were emitted per million MJ of towngas produced. This amounts to about 0.8 per cent of Hong Kong's total carbon emissions. For more information, see Towngas, *Sustainability Summary Report 2012*, 2013, www.towngas.com/Eng/Corp/SocResp/SR/pdf/2012%20SDRs%20EN.pdf (accessed 17 June 2014).

¹² Some of the questions the Government should ask include (a) how much coal generating capacity will be kept, and from the combined HKE and CLP fleet, which units can provide it with most efficiency? (b) Does the discounted payback period for replacing the units identified with new efficient ones exceed the period which it is expected to keep coal fired units regardless of the viability of adding CCS? (c) If CCS becomes viable how much coal capacity might Hong Kong have long-term and how much of this might be best met by adding CCS to existing units? (d) For portion of coal generation required which is not met by existing capacity with CCS added, does technology exist which is optimal for installing now and adding CCS later or should we wait for new technology to be developed? Similar questions also apply for replacement or additional gas units.



3. COMMENTS ON THE CONSULTATION DOCUMENT'S GUIDING ENERGY POLICY OBJECTIVES

3.1 Introduction

- 3.1.1 The Consultation Document identifies four guiding energy policy objectives. They are safety, reliability, affordability, and environmental performance.
- 3.1.2 Civic Exchange agrees with the Government that ensuring electricity is generated, transmitted, distributed and used in a safe manner is the top priority. However, we have concerns over the definitions used for the 'reliability', 'affordability' and 'environmental performance' objectives.

3.2 Reliability

- 3.2.1 When discussing 'reliability', the Consultation Document rightly notes that "as an international financial and commercial centre operating in a densely populated environment with a significant concentration of high-rise buildings (domestic and non-domestic), Hong Kong cannot afford any instability in electricity supply" (paragraph 1.7). There is also the need "to have sufficient reserve capacity to cater for any loss of generating units in order to maintain stability" (paragraph 1.9).
- 3.2.2 However, Civic Exchange wants to highlight that the Consultation Document fails to consider long-term fuel availability, which may impact physical security of supply and/or substantially increase prices. This is the other critical dimension of reliability. Consideration of this issue requires identifying risks and developing plans for mitigating these risks. For example, what action should be taken if 25 per cent of our electricity supply went out of service for a long period at no notice? To meet this sort of contingency Hong Kong needs:
 - (a) The ability to replace the capacity *immediately* by switching to alternative sources of fuel or fuel type. Civic Exchange notes that gas and pumped storage are the only energy sources which can react fast enough to 'keep the lights on' when there is a failure in another part of the power supply;
 - (b) The ability to bring other generation capacity online to restart power supply in the event of a *major failure*. Civic Exchange understands that idle coal units can be brought online in one to three days and believes that part of the Government's plan is to maintain significant unused coal capacity for this purpose; and
 - (c) Plans which can provide replacement power, in case of an anticipated, *long-term change in fuel availability*, that meets the 'affordability' and 'environmental performance' objectives within a reasonable time frame, say in three years.



3.3 Affordability

- 3.3.1 Three sets of issues should be considered when setting the affordability objective: (a) the position of consumers whose ability to pay for electricity is limited; (b) the position of consumers who can afford to pay extra for electricity; and (c) the impact on the overall competitiveness of the Hong Kong economy.
- 3.3.2 First, Civic Exchange identifies two types of consumers whose ability to pay is limited.
 - (a) <u>Low-income households</u>: a type of 'lifeline' service may be considered in which the first block of power consumption is kept low in price and then progressively higher unit prices are charged as consumption exceeds the minimum. (This is a development of the modestly 'inclined tariffs' which are already applied to all domestic consumers).
 - (b) <u>Businesses which have high electricity consumption and compete with</u> <u>businesses outside Hong Kong</u>: we suspect there are few businesses in this position. Examples may be computer data centres and electricity-intensive industries whose competitors are in the Pearl River Delta (PRD).
- 3.3.3 We do not believe there is a case for small local businesses having special issues with the affordability of electricity as these small local businesses may consider passing on the costs to their customers given that their competitors will be equally affected. Of course, higher costs will lessen demand for electricity-intensive goods and services offered locally. Thus, some small enterprises will be affected. However, over the longer term, electricity prices should reflect the true cost of service and shifts in demand in response to these higher prices are part of normal economic adjustments and are not a sound basis for providing on-going subsidies.
- 3.3.4 Second, while no one likes to pay more, there are certainly consumers in Hong Kong who can afford to pay an extra price which covers the external cost of air pollution and carbon from electricity generation. Affordability for a group of users who truly would find it difficult to meet their basic needs if power prices were much higher, should not be used as an argument for keeping prices low for *everyone*. Electricity use in Hong Kong comes with considerable external costs including carbon emissions plus localised and regional air, water and land pollution. If consumers are shielded from these external (but still very real) costs, they will consume more electricity than they would, unless faced with the full cost. This is both inefficient and wasteful of valuable resources. Nevertheless, the implementation of such a policy change would need to consider its impact on the cost of services such as the Mass Transit Railway.
- 3.3.5 Third, consideration should also be given to the impact of fuel mix choices on the overall competitiveness of the Hong Kong economy. Hong Kong imports virtually all the energy it uses. To state the obvious, higher payments for



energy imported reduces Hong Kong's competitiveness. There are issues that should be studied or explored:

- (a) To what extent the Grid Purchase option would transfer some economic activities from power generation out of Hong Kong, hence reducing its employment and tax income? and
- (b) As high retail prices encourage energy efficiency, how feasible it is to have a revenue neutral switch from tax on commercial property to a tax on energy used by it as a means to incentivise energy efficiency and make Hong Kong's economy more competitive?
- 3.3.6 Consideration of these issues leads to more nuanced balancing of 'affordability' with other objectives. For example, a higher average cost may be acceptable if affordability for low income domestic households is assisted by a more inclined electricity tariff for domestic bills with low consumption.

3.4 Environmental performance

- 3.4.1 The Consultation Document notes that 'environmental performance' covers air pollution and carbon emissions. A prerequisite to setting a sound policy is to have appropriately designed objectives. Civic Exchange believes the objectives for both air pollution and carbon emissions must be changed, as recommended below, to avoid perverse incentives.
- 3.4.2 <u>Air pollution</u>: the Consultation Document refers to emissions by source within Hong Kong. Hong Kong is, however, concerned not only with its local emissions but also the overall air quality of the PRD. This is important for two reasons:
 - (a) Hong Kong and the PRD share the same air shed. Reducing emissions from our power stations may not help improve local air quality if power generation shifts to another power plant in the PRD producing emissions from which we suffer; and
 - (b) Hong Kong should care about the quality of the air which people in other parts of the PRD breathe. Taking an attitude that it is alright to shift pollution from Hong Kong to populated areas across the border is morally indefensible.

We acknowledge the Government's effort since 2005 in working with the Guangdong authorities on setting up and running a regional air quality monitoring network, and agreeing overall air quality targets for Hong Kong and the PRD Economic Zone under 'Action Blue Sky'.¹³ It is therefore extremely important for the Government to take the same approach when it comes to the decision on fuel mix for electricity generation in Hong Kong and the impact on meeting regional environmental performance targets.

¹³ For Action Blue Sky, see www.epd.gov.hk/epd/english/action_blue_sky/action_blue_sky3.html (accessed 17 June 2014).



- 3.4.3 Civic Exchange therefore recommends that the 'environmental performance' objective of Hong Kong's future energy policy should focus on the impact of electricity generation from Hong Kong on air pollution in the PRD, rather than just emissions from power plants in Hong Kong.
- 3.4.4 <u>Carbon emissions</u>: the carbon emission numbers quoted in the Consultation Document cover the burning of fossil fuels in Hong Kong ('Scope 1'). They do not cover emissions from burning fossil fuels outside Hong Kong to generate electricity which is used in Hong Kong ('Scope 2').
- 3.4.5 This is in accordance with China and Hong Kong's reporting obligations under the United Nations Framework Convention on Climate Change Conference of the Parties (UNFCCC-COP). It has, however the perverse effect that closing down a fossil fuel burning plant in Hong Kong and replacing it with a similar one in Shenzhen will reduce Hong Kong's emissions without altering the total emissions.
- 3.4.6 This has not been an issue to date as the only significant cross-border flow of electricity has been Hong Kong's use of carbon-free power from the Daya Bay Nuclear Power Station.
- 3.4.7 If the Grid Purchase option is adopted then there will be a significant impact in this regard. Civic Exchange therefore recommends the Government, with the agreement of the Chinese Central Government, to adopt carbon emissions Scope 1 (fuel burned in Hong Kong) plus/minus Scope 2 (electricity exported/imported to mainland China) as the quantity that is reported to the UNFCCC-COP and the quantity it considers when making its contribution to reducing global carbon emissions. Mainland China would make a similar and balancing adjustment.
- 3.4.8 We believe that this is an internal matter for China as other countries will be concerned about the size of China's overall contribution to emissions reductions, including Hong Kong and Macau.

4. EVALUATING THE FUEL MIX OPTIONS

4.1 Option 1: Grid Purchase

- 4.1.1 <u>General benefits</u>: Civic Exchange agrees that connecting Hong Kong with the CSG has the benefits of potential long-term access to clean fuel sources such as solar PV, flexibility in load management, and the ability of meeting increase in future demand within shorter planning lead times.
- 4.1.2 A critical issue to meeting the 'affordability' and 'environmental performance' objectives is agreeing terms with CSG, CLP and HKE under which they will wheel¹⁴ power. This will allow Hong Kong entities to buy from low-carbon

¹⁴ By definition, 'wheeling' in this context means the transfer of electricity from the service area of one utility to the service area of another utility via transmission lines and distribution networks. See



sources rather than having CSG as the sole seller of electricity received over its grid.

- 4.1.3 The Government might initially only licence CLP and HKE to buy from sources in mainland China, but have the option to later licence other large users to make purchases. This would facilitate a gradual change in the market for electricity supply and would position Hong Kong for the possibility of moving heavily into buying from competitive mainland China-based renewable energy sources should these become the source of electricity which best meets its policy objectives.
- 4.1.4 A further benefit of integration with CSG could be having more options for carbon trading in the long term. Whether China adopts a national carbon trading scheme or a carbon tax is still uncertain and we suggest this complication should not affect decisions Hong Kong has to make at this stage.
- 4.1.5 <u>Reliability</u>: many people have raised concerns about the reliability of power supply from CSG. Issues mentioned include:
 - (a) In recent years a drought in Yunnan province has reduced the supply of hydroelectric power, causing power shortages in Guangdong Province;
 - (b) The ability of CSG to withstand a severe typhoon; and
 - (c) If one way to provide reliable power to Macau is to cut supply to customers in mainland China, how much greater of a challenge will it be to accommodate Hong Kong's larger load? Further, might such action lead to anti-Hong Kong sentiment among the PRD customers?
- 4.1.6 However, Civic Exchange argues that the key consideration when it comes to reliability should be the cost of providing the required level of reliability demanded by Hong Kong customers, and how much we are willing to pay.
- 4.1.7 <u>Affordability</u>: the Grid Purchase option places CSG, a state-owned enterprise, in a 'sole seller' position. What is to stop it from increasing the price Hong Kong pays? A further consideration is the terms on which power is taken. There is a big difference in cost if it is provided on a baseload or top-up power basis.
- 4.1.8 <u>Environmental performance</u>: Civic Exchange believes the environmental performance benefits stated in the Consultation Document for the Grid Purchase option are not valid. Our reasons are:
 - (a) <u>Reduction in Hong Kong's carbon intensity</u>: it is our understanding that CSG is already taking all the actions it can in the near and medium term to generate hydro power and renewable energy. It is therefore highly likely that an extra load from Hong Kong will have to be met by burning more

Independent Energy Producers Association, "Wheeling", California, United States of America, www.iepa.com/wheeling.asp (accessed 17 June 2014).



coal or gas. It is this 'actual' consequence of Hong Kong buying from CSG which should be compared with other options open to Hong Kong; and

(b) <u>Air pollution</u>: the extra coal and gas which will be burnt due to Hong Kong's purchase from CSG is likely to be burnt in the PRD air shed and thus also impact Hong Kong. Put simply, moving the exhaust stack for power generation from Hong Kong to mainland China improves Hong Kong's emissions statistics but brings little net improvement to the air pollution problem in Hong Kong and the PRD.

4.2 Option 2: Local Production

- 4.2.1 <u>Reliability</u>: maintaining substantial local production of electricity, particularly if coupled with integration with the CSG, increases Hong Kong's ability to respond to any future problems.
- 4.2.2 <u>Affordability</u>: the Consultation Document notes the potentially high price of gas as being the main weakness of the Local Production option. If, as we recommend (paragraph 2.6.2), Hong Kong considers building its own LNG terminal to handle the greatly increased volume of gas, it will have more purchase options and thus be less vulnerable to price volatility.
- 4.2.3 <u>Environmental performance</u>: as noted in paragraphs 3.4.4 and 3.4.7 we believe the objectives for environmental performance should be revised and that this will improve the relative merits of the Local Production option.

4.3 Other low-carbon options: renewables, CCS and nuclear power

- 4.3.1 The Consultation Document says very little about other low-carbon options, such as solar PV and CCS. As explained earlier, these options may offer attractive benefits and opportunities for a more sustainable energy future for Hong Kong in the longer term.
- 4.3.2 The Consultation Document does not provide a clear government view on nuclear energy. It does mention that Grid Purchase would be preferred over having a dedicated plant or transmission line, as it provides access to multiple sources of supply and hence:
 - (a) A higher degree of fuel diversification;
 - (b) Access to clean fuel sources such as hydro power; and
 - (c) Flexibility in load management and meeting increase in future demand within a shorter planning lead time without having to identify specific new power sources.
- 4.3.3 It also gives the view that the difference in cost of the two import options is not substantial having taken into account load management and grid access charges.



- 4.3.4 In other words, additional nuclear power imported from mainland China, if any, would come from Grid Purchase. However, it is unclear in the Consultation Document how it would change the share of nuclear in our fuel mix under this option.
- 4.3.5 Based on the limited information provided by the Consultation Document, and the ongoing technological advancement in other energy sources, Civic Exchange takes the view that low-carbon options such as solar PV, CCS and nuclear should not be ruled out at this stage. For nuclear in particular, if more nuclear power is to be imported to Hong Kong, a Daya Bay type of arrangement could be considered provided that satisfactory governance, cost and power sharing arrangements can be worked out.

5. CONCLUSIONS

- 5.1.1 Civic Exchange welcomes the Government's consultation on future fuel mix for electricity generation. This is a major step towards a long-term sustainable energy policy for Hong Kong, and a decision that needs to be made sooner rather than later, in light of the impact of energy planning on other important issues including local and regional air quality, greenhouse gas emissions, economic development, and people's well-being.
- 5.1.2 However, Civic Exchange also recognises the limitation presented by the scope of the consultation, and therefore urges the Government to take a holistic and engaging approach in the forthcoming consultations on energy efficiency, electricity market development, and climate change strategy, especially the way in which information will be provided to various stakeholders for a thorough debate in society.
- 5.1.3 One of the key questions posted in the Consultation Document is whether Hong Kong should purchase more electricity from the mainland power grid or continue to rely on local generation with more natural gas in meeting future demand. This question has triggered heated debate on a wide range of issues related to the two proposed options, including power supply reliability, local and regional environmental performance, cost of electricity, system integration and many others.
- 5.1.4 To this question, Civic Exchange agrees that connecting with the CSG has advantages, provided the contract for using the connection includes CSG wheeling power. However, the optimum extent of local production is not clear. When the definitions we recommend for the long-term reliability, affordability and environmental performance objectives are considered, there are benefits to having substantial power generation in Hong Kong and sometimes selling electricity to mainland China, as well as at other times buying from mainland China.



- 5.1.5 However, Civic Exchange argues that the fundamental underlying question that needs to be addressed in the near future is actually whether an integrated energy system with mainland China should be the way to go in meeting our future electricity need, as well as in achieving all the energy policy objectives in the long run, or rather Hong Kong should go alone (not so much 100 per cent local generation, as we are importing nuclear power from Daya Bay, but say rely mostly on local power plants).
- 5.1.6 To answer this question, the Government must set our near-term and long-term targets with respect to the various policy objectives, and assess our local generation capability and capacity in delivering safe, reliable, affordable and clean electricity in 2030 or even 2050 and beyond. The decision on future fuel mix for electricity generation as set out in the Consultation Document should be best made in the context of the assessment results. Such an assessment would take time to complete, but it is important for us to ask the right question and make the best decision.
- 5.1.7 Meanwhile, electricity demand side management and ideas such as the feasibility of using distributed natural gas are less dependent on other complicated decisions, and could therefore be discussed and implemented even before the fuel mix question.
- 5.1.8 In order to keep open as many options as possible, low-carbon energy such as additional nuclear power, and in the longer term solar PV and CCS should not be ruled out at this stage, in light of the future absolute carbon reduction target that Hong Kong should aspire to as an advanced economy.
- 5.1.9 The Consultation Document and this submission indicate the complexity of decisions on Hong Kong's energy policy. The task is not just to set a direction now, but once the direction is set to continually check and revise the pace of moving forward as circumstances change. Civic Exchange believes the optimal policy will not be a static fuel mix, but one which evolves in time with advancing technology, changing relative fuel costs and rising aspiration on environmental performance. We will re-visit our views on future energy policy when appropriate.

- end of submission -

617R00032



617B00032

Hong Kong Green Building Council Limited

16 June 2014

Environment Bureau Electricity Reviews Division 15/F, East Wing, Central Government Offices, 2 Tim Mei Avenue, Tamar, Hong Kong

By e-mail (fuel_mix@enb.gov.hk)

Dear Sir/Madam,

HKGBC's Response to Public Consultation on "Future Fuel Mix for Electricity Generation"

While Hong Kong is facing dual challenges of gradual retirement of local generating units and improving environmental targets, it is imperative that Hong Kong should explore options to achieve the highest value in the long run. Hong Kong Green Building Council Limited 香港綠色建築議會有限公司 (HKGBC) believes that proper electricity demand-side management, better environmental performance, and stable electricity supply are three of the most important considerations in deciding Hong Kong's future fuel mix for electricity generation.

Demand-side Considerations

In the consultation document published by the Government, it is estimated that the electricity demand in Hong Kong would rise at a rate of 1-2% per annual from 43,000 GWh in 2012 to about 50,000 GWh in 2023. The estimation is similar to HKGBC's prediction on building and overall electricity consumption under the business-as-usual (BAU) scenario, which are 45,500 GWh (1.49% growth per year) and 49,227 GWh respectively (1.32% growth per year) in 2023 respectively. However, under the HK3030 campaign, which was launched by HKGBC in 2012, it is targeted that there would be a 30% reduction in absolute electricity consumption in buildings by 2030 (compared to 2005 level). In other words, if the initiatives proposed in HK3030 campaign are successfully achieved, the total electricity demand of Hong Kong would reduce significantly by roughly 9,000 GWh in 2023 (compared to BAU scenario). In fact, empirical data shows that the growth rate of electricity consumption has been dropping slightly in the past few years, particularly in commercial buildings. It is strongly believed that the growth of electricity demand will be brought under control if all stakeholders put more effort on the demand side.

Tels

9

ik



Supply-side Considerations

For the two fuel mix options proposed in the public consultation, namely 1. importing more electricity through purchase from the mainland power grid and 2. using more natural gas for local generation, HKGBC is neutral to both options and does have some concerns over the reliability, affordability and environmental performance of each option. First and foremost, regarding reliability and stability of electricity supply, there are great concerns that blackouts, which happen quite frequently in mainland China, might affect Hong Kong severely if option 1 is adopted. In such case, backup generation facilities are required to be built locally, with potentially high difficulty and associated costs. Secondly, the consultation stated that the electricity tariff is likely to be doubled under both options. HKGBC believes more information should be made available for the public to assess the affordability of each option. In particular, there are concerns that over-reliance on a single source would add financial burden to Hong Kong in case the buy-in price surges dramatically. As to environmental performance. there are questions about the displacement of air pollutants and greenhouse gases emissions from Hong Kong to mainland China instead of eliminating them, especially coal and oil accounted for roughly half of the power generation portfolio of China Southern Power Grid (CSG). It is found that the CO2 emission factor of CSG is likely to be significantly higher than those of the two local power companies in Hong Kong.

Other technical concerns of HKGBC include uncertainty on the degree of control with electricity import from mainland China, question on whether the infrastructure connecting grids of Hong Kong and China could be completed by 2023, and doubt on how to meet the greenhouse gases emission target by 2020. HKGBC understands that connecting with power grid of Mainland China would benefit the long term development of Hong Kong. However, a prolonged observation of CSG performance is deemed necessary before full-scale construction of trans-border interlink. Furthermore, HKGBC would like to emphasise that the future fuel mix option should offer maximum flexibility in order to accommodate the aforesaid uncertainties from both demand side and supply side.

In view of the concerns aforementioned, HKGBC would like to propose several recommendations as follows:

1. Re-examine estimation on overall electricity consumption of Hong Kong by 2023

As empirical evidence shows that the increase rate of total electricity consumption has slowed down, it is suggested that the Government should re-examine the estimation on the overall electricity demand in 2023. With relatively lower electricity demand in years to come, the necessity for



importing more electricity from mainland China or/and building local generation units could be reduced.

2. Review policy framework of driving energy saving practices in buildings and communities

HKGBC believes a more holistic policy framework is needed to drive more vigorous energy reduction in Hong Kong, especially in buildings. In HK3030 Campaign, HKGBC has put forward a few key recommendations, including

- i. public education from cognition to action;
- ii. progressive improvement of building energy efficiency regulations;
- iii. city-wide electricity consumption benchmarking with public disclosure;
- iv. tackling the significant impacts of existing buildings head on; and
- v. increase of funding or incentive support to energy efficient or retrofit projects, independently assessed by green building rating schemes such as BEAM Plus.
- 3. Opt for a fuel mix option which provides higher flexibility in the amount of electricity supply

Given the foreseeably decreasing demand of electricity and uncertainties of the two fuel mix options, it is recommended that there should be some degree of flexibility in adjusting the amount of future electricity supply in Hong Kong. Though it is understandable that the infrastructures for cross-border transmission and local generating units both require a long period of time to be completed, HKGBC also believes over-investment would potentially cause waste of resources which could be otherwise diverted into other areas.

We hope the above would convey the strong commitment of HKGBC in facilitating Hong Kong's overall strategy on Future Fuel Mix for Electricity Generation. Sharing the same vision to foster the sustainable development in Hong Kong, HKGBC will join hand in hand with the Government to face the challenges ahead and make Hong Kong a better place for our future generations to live.

Yours faithfully,

Ir Conrad WONG Tin-cheung, BBS, JP Chairman

617B00033

617 B 00033

Α	n	n	e	X

Response Form

Public Consultation on Future Fuel Mix for Electricity Generation for Hong Kong

Please se	end this response form to us on or before 18 June 2014 by one of these means:				
nail:	Environment Bureau, Electricity Reviews Division, 15/F, East Wing,				
	Central Government Offices, 2 Tim Mei Avenue, Tamar, Hong Kong				
-mail:	fuel_mix@enb.gov.hk				
ax:	2147 5834				
rt 1 (Se	e Notes)				
rt 1 (Se	ve Notes)				
rt 1 (Se s is a	e Notes)				
rt 1 (Se s is a	 Notes) Corporate response (representing the views of a group or an organisation) or individual response (representing the views of an individual) 				
rt 1 (Se s is a	 Notes) Corporate response (representing the views of a group or an organisation) or individual response (representing the views of an individual) The Hong Kong Section of ASME International 				
rt 1 (Se	 Notes) Corporate response (representing the views of a group or an organisation) or individual response (representing the views of an individual) by				
rt 1 (Se	 Example Notes) Corporate response (representing the views of a group or an organisation) or individual response (representing the views of an individual) by				

Part 2

Fuel Mix Options

FUEL MIX Existing (2012)		IMPORT		NATURAL	6041
		NUCLEAR (DBNPS)	GRID PURCHASE	GAS	(& RE)
		23%	-	22%	55%**
OPTION 11	Importing more electricity	20%	30%	400/	
	the Mainland power grid	Total : 50%		40%	10%
OPTION 2*	Using more natural gas for local generation	20%	- , , ,	60%	20%

* The above fuel mix ratios aim at providing a basis for planning the necessary infrastructure for electricity supply. Flexibility should apply to actual deployment of each fuel type, having regard to the circumstances happening on the ground.

** Inclusive of a small percentage of oil

Part 3

Specific Questions for Consultation

Q1: How do you view each of the two fuel mix options with regard to safety, reliability, cost, environmental performance and other relevant considerations? (Please indicate your view on **EACH** of the two options.)

Option	Support	Not Support	Reason for NOT supporting (You can tick more than one box)
1		X	X Safety X Reliability X Affordability X Environmental performance Others (please specify):
2	\mathbf{X}		Safety Reliability Affordability Environmental performance Others (please specify):
Which of the Option 1 Option 2	two fuel mix c	pptions do you pr	efer? Why? (Please tick ONLY ONE box)
Reasons: (Yo Safety	ou can tick mc	re than one box	below)

Safety	X			
Reliability	Х			
Affordability	Х			
Environmental Performance	X			
Others		Please specify:		

Part 4

Q2:

Other Comments and Suggestions

Please refer to our response to Environment Bureau dated 18/6/2014



18th June, 2014

Environment Bureau Electricity Reviews Division 12/F East Wing Central Government Offices 2 Tim Mei Avenue Hong Kong

By e-mail only fuel_mix@enb.gov.hk

Dear Sir,

ASME-HK Response to Public Consultation on Future Fuel Mix for Electricity Generation

General

In response to the Environment Bureau's three-month public engagement exercise to foster discussion and solicit views from the community pertaining to the future fuel mix for electricity generation in Hong Kong (the Consultation) which deadline is on 18th June, 2014, The Hong Kong Section of ASME International (ASME-HK) Executive Committee (Ex-Comm.) has engaged our members in ascertaining their views on the subject and is pleased to render our findings on the Consultation.

Comments

As recapitulation, the two (2) options proposed fuel mix in the Consultation are:-

- Option 1 imports 20 % of electricity from Daya Bay Nuclear Power Station (DBNP) and 30 % of electricity from China Southern Grid (CSG) with the rest generated locally by gas and coal in the allocation of 40 and 10 % respectively.
- Option 2 imports 20 % of nuclear electricity from DBNP with the remaining 60 and 20 % produced locally by gas and coal respectively.

American Society of Mechanical Engineers



Out of the four (4) assessment criteria in the Consultation, namely Safety, Reliability, Cost and Environmental performance, the viewpoints the Ex-Comm. has gathered are as follow:-

- Safety: Although no detail of the fuel combination under Option 1 is provided, about 62 % of the fossil fuel in CSG's fuel mix is from coal and the rest of 38 % is shared among hydro-power, nuclear and wind. Assuming this fuel mix remains *status quo*, owing to the lower cost, coal is likely to be used to generate the 15 billion kWh of electricity which Hong Kong imports from CSG. Not only is coal the most polluting amongst a wide range of fuel sources for electricity generation, coal also emits radioactive elements such as uranium and thorium. It is estimated that in 2000 alone, 12,000 and 5,000 tonnes of thorium and uranium respectively were released into the air due to combustion of coal. Under the same atmosphere, Hong Kong and its surrounding region is likely to be equally affected by the higher exposure of radioactivity due to the potential increase of use of coal by CSG, let alone the likelihood that the imported power option may result in wider use of nuclear power installations in the nearby Guangdong Province.
- **Reliability:** Overall speaking, CSG is behind Hong Kong in terms of reliability performance. The Consultation addresses little on bridging the difference in reliability between Hong Kong and CSG, and the uncertainty on reliability has raised our concern on whether the current Hong Kong's top-class electricity supply reliability would be compromised under Option 1.
- Cost: Imported power shall not be cheaper as it requires building costly cross-boundary transmission infrastructure. Hong Kong may lose its bargaining power if heavily reliant on imported power.
- Environmental performance: Further to the reasons illustrated in Safety above, under Option 1, even though Hong Kong may specify low- or zero-carbon power generation sources ("clean power") in importing electricity from CSG, the shortfall in generation capacity Hong Kong has little influence in avoiding CSG to replenish by coal. The net improvement in the regional air quality is therefore limited, unless Hong Kong is able to intake "green power" from dedicated generation facilities, which are independent of CSG in meeting the demand.

Also, Option 1 of importing power may suppress the development of the local power industry and compromise local employment and career prospect of local professional talents. The Ex-Comm. considers Option 1 particularly detrimental to the interest of the engineering profession in Hong Kong

American Society of Mechanical Engineers



The Hone Kone Continuing

overall, as the associated lost local jobs would lead the home-grown professionals to seek employments elsewhere, draining the efforts made on developing the next generation of Hong Kong.

Summary and Suggestion

The Ex-Comm., on the said grounds, considers unless the issues raised in Option 1 are duly addressed and resolved, Option 2 serves the better interest of Hong Kong and, for the purpose of the Consultation, ASME-HK would support Option 2 for the reasons explained above.

Thank you for your attention.

Yours sincerely,

Chris Kin-Chung Cheung Chairman, Executive Committee The Hong Kong Section of ASME International

WHT

American Society of Mechanical Engineers

2014年6月17日

致:環境局

世界綠色組織就《未來發電燃料組合》公眾諮詢之回應

就特區政府展開《未來發電燃料組合》公眾諮詢,世界綠色組織欲發表以下意見, 以供政府參考。

一. 整體回應

世界綠色組織歡迎政府展開《未來發電燃料組合》公眾諮詢。鑑於本地電力公司 的燃煤發電機組將於數年後開始退役,目前是合適時間就未來的發電燃料組合諮 詢公眾,以探討如何替代這些機組,以及迎合未來的電力需求及相關環保規定。

世界綠色組織認為,選擇未來的發電燃料組合,必須從供應穩定、可靠性、合理價格及環保表現四個能源政策目標中取得平衡。若從四項政策目標作分析,兩個發電組合方案各有優劣。

本會認為,有關燃料組合的諮詢,可以與開放電力市場一併考慮,世界綠色組織 希望提供一個框架,為開放電力市場作好準備,亦為今次諮詢提供多一個角度供 市民考慮。

二. 比較內地電網購電及本港發電方案

諮詢文件提出兩個發電燃料組合供市民參考,方案一的最大特點,是從中國南方 電網有限公司(南網)購入電力,以滿足本港30%的電力需求。連同目前大亞灣核 電站輸入的電力,屆時本港有一半的電力需求將由內地所供應。其餘50%將倚靠 本地發電,當中約40%為天然氣發電、煤和再生能源則佔約10%。

至於方案二,則依賴本地發電以滿足本港電力需求,當中主要以天然氣發電,天 然氣的比例會由現時的22%,提升到2020的60%,燃煤和可再生能源佔20%,另外, 輸入核電則佔20%。

比較兩個方案,世界綠色組織認為,兩個方案的諮詢重點,是了解市民對於輸入電力的意見。事實上,若一切不變,本地發電機組退役後,則需按法例規定由天

然氣機組所取代,換言之,本地發電方案為「維持現況模式」(Business As Usual)。 而方案一則為市民提供多一個供電選擇。

供電可靠性

以供電可靠性的角度考慮,本地發電方案相對較為可靠,主要原因是本地的電力 公司在供應可靠性方面,一直表現良好。至於內地供電方案,則會為供電可靠性 添上未知數。世界綠色組織理解本港向內地所購入的發電量,只佔整個南網供應 量的極少數。假設本港每年需要約500億度電,30%約為150度,亦只佔南網不足 2%(以2012年南網的發電量為8,250億度計算)。

然而,有關供電穩定性的考慮,必須顧及其它因素,例如兩地用電高峰期是否有 所不同,以至能源政策是否有所改變等(舉例來說,內地的機組如因未達環保要 求而停機,或會做成電力供應不足)。政府如考慮此方案,則應與南網商討一個 妥善安排,以確保電力供應穩定。

然而,政府須留意,如內地無論如何缺電都要確保香港的電力供應穩定,此舉或 會導致內地一些地方缺電的情況更趨嚴重。這方面亦未必公平,更有機會引起內 地民眾的反彈,此點須加以留意。

成本及價格考慮

按照諮詢文件,兩個方案的價格差距不大,並認為「成本不應是一個重要的考慮因素」(文件第4.30段)。然而,世界綠色組織指出,即使兩個方案的成本差不多, 但並不代表兩個方案的電費沒有分別。本會預期,本地發電方案的電費或會較方 案一為高,主要是天然氣價格波動,以及電廠仍會以「固定資產平均剩值」計算 利潤。兩個因素或會令方案二的電費大幅上升。

至於方案一,預期內地的電價有機會較為便宜,然而,將來本港的電價,或會受 制於南方電網,引致議價能力較低。這方面政府亦須加以留意。

環保表現

在環保表現方面,諮詢文件預期,內地購電方案,可以讓本港達到空氣污染物減 排目標的上限,並將碳強度由2005年的水平減低約60%;至於方案二,由於仍依 靠天然氣發電,估計此方案可讓本港於2020年時達到空氣污染減排目標的下限, 以及減少碳強度約50%。 世界綠色組織認同,方案一的環保表現會較本地發電方案為佳,然而,政府必須 留意,從內地購電或會引起「污染轉移」問題。儘管本港所購入的電量只佔南網 的極少數。但本港作為已發展的城市,並不應把污染轉移至正在發展的內地。

三. 民意反彈

世界綠色組織留意到,政府在開展《未來發電燃料組合》公眾諮詢後,社會對此有強烈意見,認為本港不應依靠內地供電。有關的討論,已超出能源政策目標的討論範圍。

本會理解市民對內地供電的憂慮,然而,我們留意到,每當兩間電力公司調整電 費時,社會總有聲音批評指政府把關不力,認為政府容許兩電大量投資導致資產 淨值上升,又因天然氣價格上升,造成加電費的惡果,並希望政府開放電力市場, 以及實施區域供電,以減輕電費的負擔。然而,當諮詢文件出台後,不少市民又 反對內地供電。這種情況並不有利於能源政策討論。

本會認為,社會不應有排外心態,並應讓香港有更多的供電選擇。政府亦應盡力解釋兩個方案的利與弊,以便市民選擇。

四. 世界綠色組織的方案: 廠網分家為電力市場開放奠定基礎

世界綠色組織認為,方案一及方案二各有優劣,目前是合適時間開始具前瞻性的 討論。世界綠色組織希望提供一個框架,為開放電力市場作準備。本會認為,選 擇發電燃料組合及電力市場開放息息相關,兩者可一併考慮。

本會認為,開放電力市場的目標,是給予市民選擇電力公司的機會,以及透過引入競爭,增加效率,促成電費下降。

本會建議,兩間電力公司成立聯營公司,管理電網輸配電業務。除了兩間電力公司外,亦可以加入第三方作為管理者,第三方可以為外資或內資公司或機構。第 三方如加入,則必須參與本地電網建設,並獲特區政府批准。

聯營公司可與政府簽訂《管制計劃協議》,其利潤計算方法,為電網相關業務(輸 配電)的固定資產平均淨值,乘以准許利潤百分比,以確保聯營公司有經濟誘因, 維持電網質素。

本會認為,分拆電網將有利開放電力市場。本會強調,目前本地電網為電力公司 資產,然而,政府並不一定要斥資購買電網,電力公司亦可成立聯營公司分拆電 網,達到相同目的。

聯營公司由本地兩間電力公司及第三者機構共同管理,有助實現兩電聯網。如加 入的第三者為內地機構,亦有助與內地聯網,輸入內地電力或向內地賣電。電網 的准許利潤,亦可較發電機組為低。以上的因素在長遠而言,均有助電費價格下 調。如有需要,可限定從境外進入的電力,不可超過某一個百分比,如10-20%。

本會預期,落實開放本地電力市場相關的基建設施,估計需時十年,政府可待收 集市民對2018年後電力市場發展的意見後再作決定。

五. 總結

本會認為,今次諮詢的主要目的,是要了解市民是否接受由內地供電,事實上, 我們留意到市民十分關注今次的諮詢,惟市民所關注的方向,較集中於本港的電 力供應會否受內地主導,多於能源政策的討論。

在目前的政治氣氛下,本會建議政府透過不同宣傳渠道,多向市民解釋,並盡早 就2018年電力市場開放展開公眾諮詢,以便公眾及早掌握未來電力市場發展的趨勢,以減少政府與市民雙方的誤解,落實對本港最有利的電力市場發展方向。

完

如就上述文件有任何查詢,請與本會聯絡。 世界綠色組織行政總裁 余遠騁博士 世界綠色組織政策倡議經理 黃俊賢 致:環境局電力檢討科

香港添馬田美道二號 政府總部東翼 15 樓

香港洗衣服務業聯會就《未來發電燃料組合公眾諮詢文件》之意見書

政府於今年3月19日,就香港的未來能源組合展開公眾諮詢。是次的公眾諮詢, 對香港未來的發展至為重要。香港洗衣服務業聯會現謹就《未來發電燃料組合公 眾諮詢》提交書面意見,以重申本會於5月12日發展事務委員會會議上所提交 之立場,冀環境局電力檢討科詳加考慮。

1. 維持合理電費的冀望

香港洗衣服務業聯會成立的使命,是提升同業對安全的認知,並為同業提供資訊 使同業有良好的營商環境。洗衣業近年已因租金上漲及最低工資條例,導致經營 成本不斷上升,對業界造成龐大的壓力。電費亦是洗衣業主要成本之一,本會希 望未來的發電燃料組合除了考慮保護環境等因素之餘,更必需把電價維持在合理 水平。

2. 穩定及可靠電力對洗衣業的重要性

香港經濟發展迅速,能成為世界級金融中心,實有賴穩定可靠的電力供應。洗衣 業的作業模式亦十分依賴安全、穩定和可靠的供電。特別是酒店及門市客衣洗滌 同業,他們面對時間的急迫性是非常依賴穩定供電,現時香港其接近零的停電次 數和穩定的電力供應有助於提高同業的安全標準,從而提升洗衣業的形象和增強 競爭力,以創造更多不同的商機。未來的發電燃料組合,香港洗衣服務業聯會要 求政府以確保穩定可靠的電力供應為重要考慮因素。

3. 廣泛聽取持份者意見以制訂合適方案

香港多年來一直享有安全及可靠的電力供應,以維持我們的生活質素及經濟競爭力。一旦供電可靠度降低或大幅增加電費,均對香港造成重大損失。故本會希望環境局在制定未來發電燃料組合時,必須進行長遠的規劃及審慎考慮,在環境保護的基礎上選取對香港未來發展最有利及具彈性之方案。本會建議政府廣泛聽取社會階層持份者的意見,審視有否其他適合香港的發電燃料組合,從而制訂對香港長遠社會及經濟利益有利的方案,讓香港能以具競爭力的電價,維持世界級的供電水平。

黄達<u>強</u> 主席 香港洗衣服務業聯會 二零一四年六月十日

5

617B00036



由:梁繼昌立法會議員辦事處 致:環境局 聯絡人: 2014年6月17日

梁繼昌立法會議員辦事處 就《未來發電燃料組合諮詢文件》的意見書

梁繼昌立法會議員今日就政府發表的「未來發電燃料組合諮詢文件」提 交了意見書。此意見書詳述了諮詢文件中提出的兩個發電方案的考慮因 素與利害,並提出政府應採納的方案及政策措施,概要如下:

- 综合供電穩定性、能源自主與環保表現三大原則,梁繼昌議員支持 「本地發電方案」,即利用更多天然氣作本地發電,同時反對「網 電方案」增加對內地電力供應的依賴;
- 當局應重新確立可再生能源的目標比例,同時應研究推動社區規模 的可再生能源項目的可行性與成本效益,而不是在現階段貿然放棄 進一步發展可再生能源;
- 政府應採納方案二,並參考新加坡的例子,研究在本地增建天然氣 基礎設施及其他能源儲備技術的可行性,以保障燃料多元供應和能 源自主;且同時在打破兩電壟斷、引入市場競爭的前提下,配合電 力市場改革的方向發展。

梁繼昌議員現將意見書詳述的政策建議交予環境局考慮並爭取落實有 關建議,以求長遠地改善本港燃料組合的排放表現和保障香港的能源自 主。

意見書全文詳見附件。



2014年6月17日

梁繼昌立法會議員辦事處

《未來發電燃料組合諮詢文件》意見書

- 環境局於今年三月發表《未來發電燃料組合諮詢文件》,就兩個燃料組合方 案進行諮詢。但該兩個發電方案,最大的分別僅在於是否向「南方電網」購 電以輸入更多電力。而文件反映局方對「網電方案」的明顯傾向性,例如強 調方案能增強本地兩個電網的聯繫、引入各類香港沒有的清潔燃料,同時淡 化「南方電網」的供電可靠性問題。文件亦沒有提供兩個方案的估算發電成 本、供電可靠性的資料,與方案如何促進電力市場改革的具體細節,令公眾 難以實質比較兩個方案的利害。
- 基於現有資訊,並考慮到供電穩定性、能源自主與環保表現三大原則,我們 支持「本地發電方案」,即利用更多天然氣作本地發電;同時,我們反對「網 電方案」增加對內地電力供應的依賴。

方案一「網電方案」可靠性成疑

3. 內地輸電的建議,涉及供電穩定性的問題。目前,香港的供電可靠度達 99.999%;以中電為例,在 2011 年至 2013 年間,其一般客戶每年經歷的意 外停電時間平均只有 2.3 分鐘¹。相反,「南網」的城市客戶在 2011 年至 2013 年間,每年平均停電時間分別為 5.2 小時、3.21 小時及 2.31 小時,2013 年 的供電可靠性值僅有 99.974%;其中,廣州客戶每年平均停電時間分別為 1.79 小時、1.79 小時及 1.47 小時,深圳客戶則為 1.28 小時、1.12 小時及 0.83 小 時²。我們實在無法想像長達 1 小時的停電時間,對香港帶來的經濟損失及 社會風險會有多大。加上當局亦沒有進一步披露關於「南網」城市客戶的累 計停電時間與事故頻率,單從現有資料判斷,「南網」的供電可靠度水平, 實在難以接受。

¹ 中電網站,見

<https://www.clp.com.hk/ourcompany/electricityjourney/powergrid/supplyreliability/Pages/supplyrel iability.aspx?lang=tc>

² 立法會 CB(1)1436/13-14(04)號文件

- 而且,方案建議以網對網形式輸電,如廣東電網出現故障,將會連帶影響香港的供電穩定性,令兩電需要增加後備發電容量以應對潛在事故風險;加上香港與廣東省的用電高峰期都集中在夏季,兩個電網互補性較低。
- 5. 此外,由於香港與廣東省屬不同的司法管轄區域,香港要進行有效監管,甚至在出現事故後追究責任,均存在相當程度的困難;有報導亦質疑「南網」運作的透明度不足,一旦發生停電,香港政府難以追究³。但諮詢文件卻未有就此提供實質數字,也未有闡明「南網」將如何提高供電可靠度、以至香港政府如何落實聯網後的監管、危機處理與通報機制。種種因素,都增加了公眾的合理疑慮。

內地購電恐增加依賴

- 6. 從內地電網輸入額外 30%的電力,客觀效果是增加了對內地電力的依賴。香港政府在商議這類供電合約時是否有足夠的議價能力,同樣令人憂慮。同時,由於文件缺乏資訊評估跨境輸電所需要興建的基建的成本對將來電費加幅的影響,局方又以影響將來的談判及商業敏感資料為由,拒絕向公眾披露相關資訊(包括政府委聘進行的《從中國南方電網購買電力的可行性》研究報告),如在這個情況下要求公眾二選一、甚至貿然採納「網電方案」,實與公眾利益相悖。
- 7. 諮詢文件指出,由於香港在 2023 年需要從「南網」輸入的電量只佔總發電量不足 2%,加上「內地的政策方向是將會進一步增加使用清潔能源」,因此內地購電「應不會使珠三角地區的整體排放量顯著上升」4。然而,根據「中國電力企業聯合會」的報告,「南網」在 2013 年的主要發電燃料仍然是煤(62%來自化石燃料),向內地輸入電力,客觀效果是增加內地的供電需求,由於文件亦沒有闡述當局如何能指定內地以潔淨能源供電輸港,否則邊際燃料很大可能是燃煤,增加當地的排放量,變相造成「排放轉移」。而且,當局亦承認發電來源上網後不能分辨5,因此,在這方案下當局根本無法有效控制及監察排放表現,難以有效落實改善區域空氣質素、減低排放的目標。

³ 蘋果日報,「東莞停電大混亂 港人憂聯網無保障」,2014年6月7日,見 < http://hk.apple.nextmedia.com/news/art/20140607/18748539>

⁴ 諮詢文件 4.17 段,頁 32

⁵ 政府新聞公報:環境局局長會見傳媒談話內容(二),2014年3月19日

方案二「本地發電」

- 8. 以增加天然氣作本地發電的方案,令兩電可靈活地從全球天然氣市場尋找最便宜、可靠的供應。由於天然氣是可儲存的燃料,輸入來源亦有較多選擇,只要政府推動兩電發展天然氣儲備,就能有效減低天然氣市場價格波動的影響,確保穩定供應。如此一來,方案將會增加燃料來源的多元性,長遠減低香港對內地輸港燃料的依賴。而利用更多天然氣作供電燃料,香港同時能維持既有的高供電可靠性。
- 文件提及,「本地發電」方案如經採納,當局須允許兩電興建新的發電機組, 或會增加將來消費者可能要承擔的擱淺成本,因而會增加電力市場引入競爭時的限制⁶。但事實上,在政府提出上述方案之前,由於現有燃煤機組將於 2017年起陸續退役,兩電因應排放管制收緊,本來的方向已是增加使用天然 氣以符合排放上限。因此,文件中的假設並不成立。
- **10**. 而從改善空氣質素及減排的目標而言,增加本地的天然氣發電,亦能有效減 少排放,同時令當局能有效監察及控制兩電的排放表現。
- **11**. 因此,綜合供電穩定性、能源自主與環保表現的三大原則,我們的立場是支 持方案二,因為該方案明顯較方案一可取。

可再生能源的發展

- 12. 諮詢文件提及 2012 年香港的燃料組合中,可再生能源的比例為 2%。但文件 卻沒有明確說明兩個方案中的可再生能源(包括轉廢為能)的目標比例為 何,亦沒有解釋它們與環境局於 2010 年發表的《香港應對氣候變化策略及 行動綱領》諮詢文件所建議的 3%至 4%的目標比例有否不同以及有關理據。 文件只是強調在香港廣泛引入可再生來源的限制,當局在回覆梁繼昌議員的 書面質詢7時,亦沒有進一步交代當局有否全面檢討現時已發展的可再生能 源發電項目的成本效益,包括科技發展對長遠減低成本的影響。
- 13. 我們建議當局重新確立可再生能源的目標比例,同時應參考國際上的例子, 研究推動社區規模的可再生能源項目、將過剩的產出電力接駁到電網的可行 性與成本效益,而不是在現階段貿然放棄進一步發展可再生能源。

能源自主的重要性

⁶ 諮詢文件 4.41 段,頁 37

⁷ 環境局局長於 2014 年 6 月 11 日在立法會會議上的書面答覆。

- 14. 在國際層面,能源保障(Energy Security)已是最主要的全球政治議程之一⁸。 現時,不少已發展國家都致力透過增加能源供應多元性、提高能源效益、投 資基建及科研創新、開放市場等全面政策措施,以落實能源自主、推動可持 續發展與綠色經濟的目標。以新加坡為例,當地近八成的發電燃料為天然 氣,來源包括四條取道馬來西亞及印尼的離岸天然氣管道,及由新加坡政府 投資興建並於去年正式投入運作的液化天然氣接收站。新加坡政府將會逐步 增加該天然氣接收站的容量至每年9百萬噸,同時分別擬建一座大型浮動式 液化天然氣平台及東南亞首個地下儲油庫。此外,當地政府亦有成立專責部 門,以推動全面的能源策略,及投資能源研究開發,促進潔淨能源發展及增 加就業。由於新加坡同時有發展出口煉油業,全面的政策措施及有利的地緣 因素,令新加坡克服缺乏國內天然資源的限制,成為產業多元、具高競爭力 的成熟經濟體⁹。
- 15. 相對而言,作為同樣依賴進口能源的發達城市,香港政府在保障能源自主的 主導角色卻遠遠不足,未有善用既有的地緣與經濟優勢。現時,香港不但缺 乏全面的能源政策,也無意長遠增加本港的能源儲備。由於香港相對其他已 發展地區較受外圍因素影響,香港政府須提高危機意識,提高本港更靈活地 應對能源價格波動及其他不可預見因素的能力。其實政府大可參照現時國際 上的戰略石油儲備做法¹⁰,或將進口天然氣納入法例管制(如現行的《儲備 商品條例》(第 296 章)),以確保天然氣有穩定供應,和足以應付緊急或短期 供應不足或價格波動的儲備。

政府應發展天然氣儲備

16. 鑒於兩個發電方案都會利用更多天然氣發電,政府的未來方向,實應支援兩 電去投資增建更多天然氣發電的基建(例如本地儲存庫、液化天然氣接收站 及浮動式液化天然氣平台),以符合能源自主的目標。遺憾的是,當局僅表 示如兩電提交有關興建天然氣基建及其他技術的資本投資建議,當局「會做 好把關工作」¹¹,減低投資風險,反映香港政府在保障能源自主的承擔與主 動性,落後於國際大勢。

⁸ 可参考 World Economic Forum, The New Energy Security Paradigm, Spring 2006.

⁹ Asia Pacific Energy Research Centre (APERC), APEC Energy Overview 2013, 2014.

¹⁰ 如國際能源署(IEA)於 2001 年的有關協議訂明 28 個成員國需要按該國過去一年的石油進口量,儲備等同足夠 90 天的數量的石油。

17. 我們認為,政府應該採納方案二,並參考新加坡的例子,研究在本地增建天然氣基礎設施及其他能源儲備技術的可行性,以保障燃料供應的多元性;且同時在長遠改善利潤管制模式、打破兩電壟斷的前提下,配合電力市場改革的方向發展。

總結

18. 基於現有資訊,並考慮到供電穩定性、能源自主與環保表現三大原則,我們 支持方案二,即利用更多天然氣作本地發電,同時反對方案一增加對內地電 力供應的依賴;方案二一經採納,政府應發展本地的天然氣儲備設施,保障 能源供應穩定,並同時在打破兩電壟斷、引入市場競爭的前提下,配合電力 市場改革的方向發展。

617B00037

葵涌邨碧葵樓互助委員會

Kwai Chung Estate Pik Kwai House Mutual Aid Committee

政府總部環境局 電力檢討科:

你們好!我呂嘉蓀是葵涌邨碧葵樓互委會主席、2014/4/17 寵奉『政府總部環境局』來函諮詢有關未來電力事項。

回顧幾十年來本港一直利用燃煤發電機組,因將會自 2017 年起陸續退役,並提示二個方案徵詢意見。為此本人呈遞愚見 責科參閱:

綜觀目前發電方式成本均不經濟,現已有新方式《浮沉動力》來發電,建廠成本 較亷,且對環保更有幫助。希望本港亦能利用而令香港居民減輕支出。該設備裝 置經濟,簡單實用,投產快速,一年建廠即可投產,有關之估算及效益隨函呈奉 (見附件),請撥冗閱覽。(如有任何垂詢,請隨時賜電 當盡情告稟)

順頌台安企盼賜示!

呂嘉蓀草書 2014/6/14



517800037
發電方式	每度成本造價 RMB/kw	發電效率	資源消耗	環境安全	發展空間
火力	0.30	32%~35%	煤炭	高壓、高熱、三癈 的的排列放。	能源接近枯竭。
水力	0.40	34%~43%	水資源	建立水壩,一旦崩 場,後果嚴重。	各地水源分佈不均。
核電	0.90	36%	核能	高輻射、高壓。	需高技術且輻射大。
風力	0.50	30%~40%	自然風	對農作物主造成影 響。	自然條件高且分佈 不均。
太陽能	3.30	12%~16%	太陽光	其產業鏈上遊對環 境威脅大。	成本極高。
浮沉動力	0.03~0.05	90%	無消耗	很安全。	成本低,零污染,零 排放,發展空間大。

現有發電方式的對比

Comparison of existing power generation

Method of generation	Cost per unit of power RMB / kw	generation efficiency	resource consumption	environmental safety	development
Fire power	0.30	32% to 35%	coal	high-pressure, high- temperature, three kind waste the release.	Energy close to depletion.
Hydraulic power	0.40	34% - 43%	water resources	build dam	Unevenly distributed the water.
Nuclear power	0.90	36%	nuclear	high radiation, high pressure.	Require high technology and large radiation.
Wind power	0.50	30% to 40%	natural wind	Some impact of main crops.	High natural conditions and uneven distribution.
Solar power	3.30	12% to 16%	sunlight	upstream industry chain big threat to the environment	High costs
Fuchen power	0.03 to 0.05	90%	non-consumption	very safe	Low cost, zero pollution, zero ejection, new development

Carson Lu

Page 1

投資估算及效益評估

I,投資:

假設首期 30,000(三萬)千瓦的裝機容量一期工程建設,電廠投資約 400,000,000(四億)元 "物體動力可再生能源",佔地約 20 畝(1.5 公頃)。二期擴建工程為 450,000(四十五萬)千 瓦的容量,投資約 5,500,000,000(五十五億)元,佔地面積約 300 畝(20 公頃)。第一階段建 設期,建廠約一年後即可投產,預計運營生產工人和管理人員總共 20 人左右。

Ⅱ,產量測算:

首先是投入建設(土地和建築物),第二年投產。30,000(三萬)千瓦規模的電廠,按照目 前燃煤火力發電機組按照"物體動力可再生能源"電廠脫硫脫硝標桿上網電價每千瓦時0.45 元計價,總收入是大約一年的執行現況:30000 x 22 小時 x 30 天 x 12 月 = 240,000,000 千瓦x 0.45 元=108,000,000(一億零八百萬)元。

(1)工資: 20 x6,000 元/月(包括獎金和福利等) x12 月=1,440,000(一百四十四萬)元;

(2)員工福利保險,改善生活費用每人每年 20,000 元×20 人= 400,000 (四十萬)元;

(3)設備的維修保養費用每月100,000(十萬)元 x12個月=1,200,000(一百二十萬)元;

(4)提取1,000,000(一百萬)元為經營備用金;

(5)所得税: 108,000,000(一億另八百萬)×25%=27,000,000元

以上合計: 31,040,000 (三千一百零四萬)元。

利潤: 108,000,000-31,040,000=76,960,000(七千六百九十六萬)元。

投產後可申請國家扶持和相關補貼,爭取五年即可收回全部投資。

II · 效益評估

(1) "物體動力可再生能源"發動機直接驅動發電機,按照規定衹需二道工序,你可以搞 成全自動化的工廠,工人們只要原來的火力發電廠的10%,一百萬千瓦電廠只要一百左右人就 夠了。百萬千瓦火電廠,三十幾道工序因不能完全自動化,工人需要大約達到近千人。

(2) "物體動力可再生能源"發動機驅動的發電機是物體動力形成機械能驅動發電機供電。因此,能源是零消耗,原料成本是零支出,倉儲也為零倉儲,激底解決存儲問題。

而火力發電廠是使用煤炭燃料經過三十幾道工序流程來驅動的發電機,原料成本為 0.25 元千瓦時, 倉儲費 0.02 元,每千瓦時原料成本為 0.27 元。

(3) "物體動力可再生能源"發電不用水或少量的水。火電廠使用大量的水,但也增加了 生產成本。

(4) "物體動力可再生能源"不排放任何廢棄物。因此,三維環境零污染,不必花任何環境保護成本,也減少了環境污染。

火電廠,廢氣排放,廢水,廢物排放對三維環境有污染,綠色花的錢每年就很多了,造成環境 的污染也是一個很大的損失。 (5) "物體動力可再生能源"各種氣候條件對生產發電設備沒有任何影響,全天候的發電 廠,且設備運行平穩,長時間的生產,高品質的電源,在生產過程中不受外界,正常生產率高, 運行成本低。它的幾十個極限高效生產指標,帶來很高經濟效益,每度電的生產成本,只有 0.05 元。

(6) "物體動力可再生能源"的計劃,投資建廠時間短。因為它的全套設備均在生產基地 完成,安裝時間短,投資回收快,投資成本低。

(7)"物體動力可再生能源"是機械發電的做法是一個零能耗,零排放,零污染,零安全隱 患,使用這個方法來確保長期的區域生活環境無污染發電,三維環境在天上,地上,地下都得 到了有效的保護,沒有帶來許多環境問題。另外,暴雨,乾旱,洪水,地震,戰爭等等造成額 外的災難。

Ⅳ · 電源,傳輸,穩定的電能質量:

由於能源電力生產的對象穩定,所以使生產發電設備可以很穩定,電源,輸電,電能質量是非 常穩定(供電在這裡說,輸電,電能質量是非常穩定的,是單電源供電,輸電,功率可以保證 質量,質量比經過調整後電網穩定)。

此方法不會產生因缺乏原材料和電能質量的影響電力,氣候變化將不會影響,一旦產生電力生 產正常發電能量可保持數十年。因為這種發電方法是全天候,全年發電,高電能質量和穩定性 是未來一代的主要方法。

附注:

- (1)以上單價均依人民幣計算及國內情況估算,所有測算均應按照準備設廠當地實際情況調 整參考。
- (2) 如認同其可行性,盼陽示預約同赴實地(考證檢驗)已有的小型"物體動力可再生能源" 發電設置。

1

限示+#+++·	
4	
呂嘉蓀(主席)	
電話:	
電郵:	

E.& O.E.

Carson Lu



617B00038

10 June, 2014

<u>首席會長</u> 王國強 博士 工程師 SBS JP

會長 簡松年 律師 BBS JP

51

. 10

<u>主席</u> 陳建強 牙科醫生 JP

<u>常務副主席</u> 高永文 醫生 BBS JP

副會長

梁和平 會計師 JP 曹貴子 醫生 李偉庭 牙科醫牛 胡國志 會計師 李承光 牙科醫生 陳維端 會計師 羅義坤 會計師 JP 陳旭明 測量師 黎應華 牙科醫生 李深和 醫生 MH 馮宜亮 醫生 鄺心怡 建築師 MH 林雲峰 建築師 JP 劉興達 園境師 林筱魯 規劃師 JP 袁國強 資深大律師 JP 李律仁 大律師 王桂壎 律師 JP 何君堯 律師 廖凌康 測量師

副主席

陳東岳 測量師 黃煒培 會計師 黃偉賢 工程師 陳紹雄 工程師 蕭妙文 博士 測量師 工程師 蕭妙文 博士 測量師 工程師 黃玉志庸 律師 工程師 葉鉅雲 律師 黃江天 律師 馬恩國 大律師 吳德龍 會計師 王紹恆 建築師 李凱茵 牙科醫生

秘書長

張菁菁 會計師

<u>副秘書長</u> 簡汝謙 律師

羅錦基 工程師 梁永鏗 律師

<u>司庫</u> 彭漢中 會計師 Mr. WONG Kam Sing, JP Secretary for the Environment Environment Bureau

Mr. Woy Dear



Public consultation on the future fuel mix for electricity generation

The Association of Hong Kong Professionals is a non-profit making organization with around 400 members from different professional disciplines including healthcare, accounting, architecture, engineering, survey, etc. One of our objectives is to contribute our professional views and constructive recommendations on public policies to the Government for the continuous prosperity of Hong Kong.

We agree with the consultation document that safe and reliable electricity at an affordable price is crucial for Hong Kong's continuous developments. At the same time, we must also not forget to protect and improve our environment for the well-being of our future generation in Hong Kong. These are the key elements of a sound policy framework in relation to energy and electricity supply.

Before moving on to provide our views on the two proposed options as stipulated in the consultation document, we would like to acknowledge that the current electricity supply and services provided by the two power companies are among the best in world-wide standards. Any major revamp or change to the current arrangements and frameworks should be carefully studied before implementation such that our current excellent service level enjoyed by the public would not be jeopardized.

SAFETY & RELIABILITY

Hong Kong is a densely populated city with extremely high reliance on a reliable electricity supply for our daily live and economic activities. The reliability and safety of the electricity supply should not and cannot be compromised.

In terms of safety and reliability of supply, we are confident that option 2 (using more natural gas for local generation) will deliver good results based on the excellent track records of both power companies, provided that an adequate and reliable supply of natural gas is available. On the other hand, although greatly improved over the past few years, the reliability of electricity in Mainland needs to be further improved to catch up to Hong Kong's current standards. Furthermore, power rationing and shortages can still be observed in the Guangdong area, indicating that the generating capacity and transmission network need to be further enhanced to meet its own local demand. In the near term, we are cautious on the Mainland power grid's ability to continuously supply reliable power



to Hong Kong. However, in the longer term, we believe option 1 (importing more electricity through purchase from the Mainland power grid) is technically feasible and its safety and reliability outcome can be as good as that of option 2 if proper planning and sufficient local back-up generation is retained in Hong Kong.

In the consultation document, Macao was quoted as a reference case for the possibility of reliance on importing electricity. We must emphasize that the situation in Macao is substantially different from that in Hong Kong, in terms of their economic activities & scope and model of living. For example, Hong Kong relies heavily on a highly sophisticated railway system (with 5 million passenger trips per day) for public transportation while Macao does not. Hong Kong's economy is far more diverse than Macao's with many more industries that depend on a reliable supply of high quality power such as banks, financial services, data centres and a world-class international Furthermore, Hong Kong is profoundly reliant on the use of lifts and airport. escalators which are essential to almost everyone's living and well-being. Therefore, the requirements on reliability standards are also substantially different between the 2 cities. When assessing risk, it is important to note that both aspects of probability and impact should be taken into consideration. The impact of power interruptions or deterioration of power quality is far greater in Hong Kong compared to Macao. If option 1 is to be pursued, careful studies and planning as well as close coordination with the Chinese counterparts and authorities are needed and crucial.

<u>COSTS</u>

In terms of costs, it was suggested in the consultation document that the average unit cost of electricity of both options would be doubled as compared to the unit generation cost over the period from 2008 to 2012 based on known information and projections. We fully understand and appreciated that costs and environmental performance could be competing with each other down the road. More often than not, there is a price to pay for a better environment. While the absolute level of electricity costs is important to the livelihood of residents and the competitiveness of business in Hong Kong, the foreseeability of future electricity cost movements may be equally as important. If electricity costs can be projected more accurately, Hong Kong's community can get better prepared for mitigating the cost changes ahead, e.g. investing in energy efficiency and conservation measures. As observed from the international fuel markets, energy prices could be very volatile. In addition, there are still uncertainties about the commercial arrangements involved with further power imports if option 1 is to be pursued. For example, if the additional power purchase from the Mainland is to be settled in RMB, the long term trend of appreciation (or depreciation) of the RMB needs to be taken into account as well. Using Macao as an example, it can be observed that their power purchase price has increased by around 27% during the period covering 2008 to 2013, partly due to the appreciation of RMB. We should also be mindful that when local generating capacity is not sufficient to meet its local demand (as in the case

<mark>首席會長</mark> 王國強 博士 工程師 SBS JP

會長 簡松年 律師 BBS JP

<u>主席</u> 陳建強 牙科醫生 JP

.1

常務副主席

高永文 醫生 BBS JP

副	會	長	
~ ~		1	~

梁和平	會計師 JP	
曹貴子	醫生	
李偉庭	牙科醫生	
胡國志	會計師	
李承光	牙科醫生	
陳維端	會計師	
羅義坤	會計師 JP	
陳旭明	測量師	
黎應華	牙科醫生	
李深和	醫生 MH	
馮宜亮	醫生	
鄺心怡	建築師 MH	
林雲峰	建築師 JP	
劉興達	園境師	
林筱魯	規劃師 JP	
袁國強	資深大律師 J	P
李律仁	大律師	
王桂壎	律師 JP	
何君堯	律師	
廖凌康	測量師	

副主席

陕宋古	/则里曰
黃煒培	會計師
黃 山	測量師
潘偉賢	工程師
陳紹雄	工程師
蕭妙文	博士 測量師 工程師
方玉輝	醫生 MH
錢志庸	律師 工程師
葉鉅雲	律師
黃江天	律師
馬恩國	大律師
吳德龍	會計師
歐永偉	會計師
王紹恆	建築師
李凱茵	牙科醫生

秘書長

張菁菁 會計師

副秘書長

簡汝謙 律師 羅錦基 工程師 梁永鏗 律師

<u>司庫</u> 彭漢中 會計師



of Macao), there is possibility that the bargaining power for a fair deal could be reduced. Furthermore, it is anticipated by many that the fuel mix in Mainland will become cleaner over the longer term. This is encouraging but will also likely increase the cost of power purchase from Mainland as well.

ENVIRONMENTAL PERFORMANCE

Mitigating the impacts of climate change is a global issue which requires dedicated efforts from everyone around the world. Meanwhile, air pollution is a regional issue and should be controlled and managed through regional efforts. We are happy to see that the Hong Kong Government and Guangdong Government have already started working closely together in improving air quality in the Pearl River Delta Region.

In terms of environmental performance, it is noted that option 1 would lower local emissions further when the cross-boundary infrastructure is fully completed in or around 2023, while the longer term prospect of emissions reduction under option 2 would be limited. We agree that through stronger integration with Mainland, it would open up more opportunities for improving our local environment in the longer term. However, we have the concern that importing power from the Mainland will mean that we are simply exporting the associated air emissions to Guangdong. It is observed that the major source of fuel for electricity generation in Guangdong is coal for the foreseeable future, given the constrained pace of nuclear and gas generation development as well as increasingly difficult development of hydro resources from Yunnan. By importing power from China Southern Grid (although the physical connection must be linked to Guangdong), this will inevitably increase air emissions in Guangdong and will be likely to have an impact on Hong Kong's air quality; unless we can be assured that the imported power from CSG is generated from clean sources. Furthermore, if there are other practicable solutions available for improving our environment in a more certain and straight-forward manner, then we should also seriously consider implementing those short lead-time measures as well, with an aim to improve the living standards in Hong Kong as soon as possible. In our view, we don't see there is any substantial conflict between having more local gas-fired generation and planning to enhance the electricity interconnection with Mainland. Both can complement each other as long as the costs involved, benefits generated and potential risks are made known to the community.

POST-2018 ELECTRICITY MARKET

In the consultation document, it is suggested that enhancing interconnection between the HK and Mainland grids can provide more room to introduce competition at the generation level. At this stage, when there are no details provided for the actual commercial arrangement for further power imports, it is difficult for us to assess and make a fair comparison between the 2 options in terms of their implications for future electricity markets. For illustration purposes, if the power purchase agreement with the

首席會長

. .5

王國強 博士 工程師 SBS JP

1.10

會長 簡松年 律師 BBS JP

主席

陳建強 牙科醫生 JP

常務副主席 高永文 醫生 BBS JP

副會長

梁和平 會計師 JP 曹貴子 醫生 李偉庭 牙科醫生 胡國志 會計師 李承光 牙科醫生 陳維端 會計師 羅義坤 會計師 JP 陳旭明 測量師 黎應華 牙科醫生 李深和 醫生 MH 馮官亮 醫牛 鄺心怡 建築師 MH 林雲峰 建築師 JP 劉興達 園境師 林筱魯 規劃師 JP 袁國強 資深大律師 JP 李律仁 大律師 王桂壎 律師 JP 何君堯 律師 廖凌康 測量師 副主席

陳東岳 測量師 黃煒培 會計師 黃山 測量師 潘偉賢 工程師

陳紹雄 工程師 蕭妙文 博士 測量師 工程師 方玉輝 醫生 MH 錢志庸 律師 工程師 葉鉅雲 律師 黃江天 律師 馬恩國 大律師 吳德龍 會計師 玉紹恆 建築師 李凱茵 牙科醫生

<u>秘書長</u> 張菁菁 會計師

<u>副秘書長</u> 簡汝謙 律師

羅錦基 工程師 梁永鏗 律師

<u>司庫</u> 彭漢中 會計師



<u>首席會長</u> 王國強 博士 工程師 SBS JP

1.1

會長 簡松年 律師 BBS JP

主席

陳建強 牙科醫生 JP

常務副主席

高永文 醫生 BBS JP

副會長

梁和平	會計師 JP
曹貴子	醫生
李偉庭	牙科醫生
胡國志	會計師
李承光	牙科醫生
陳維端	會計師
羅義坤	會計師 JP
陳旭明	測量師
黎應華	牙科醫生
李深和	醫生 MH
馮宜亮	醫生
鄺心怡	建築師 MH
林雲峰	建築師 JP
劉興達	園境師
林筱魯	規劃師 JP
袁國強	資深大律師 JP
李律仁	大律師
王桂壎	律師 JP
何君堯	律師
廖凌康	測量師

副主席

陳東岳	測重師	
黃煒培	會計師	
黃 山	測量師	
潘偉賢	工程師	
陳紹雄	工程師	
蕭妙文	博士 測量師	工程師
方玉輝	醫生 MH	
錢志庸	律師 工程師	
葉鉅雲	律師	
黃江天	律師	
馬恩國	大律師	
吳德龍	會計師	
歐永偉	會計師	
王紹恆	建築師	
李凱茵	牙科醫生	

5

秘書長

張菁菁 會計師

副秘書長

簡汝謙 律師 羅錦基 工程師 梁永鏗 律師

司庫

彭漢中 會計師

Mainland grid is a long-term contract with fixed annual off-take quantity, the level of competition may not be substantially different from the current situation. More importantly, electricity market reform should take into account of many different factors, e.g. electricity prices, reliability of supply, environmental standards, legal frameworks, responsibilities of different market players, establishment of regulatory bodies, etc. As mentioned earlier, any major revamp or change to the current arrangements and framework should be carefully studied before implementation. In our view, market change or reform should only be done after further public consultation. The decision in the choice of future fuel mix should not pre-empt the decision on future market structure.

SUMMARY

Hong Kong enjoys a high quality supply of electricity and this should not be taken for granted. We welcome the Government's approach in proactively planning for the future. Any major revamp or change to the existing framework should be carefully studied, so as not to jeopardize the current situation. In terms of safety, reliability, costs and environmental performances, both options have its own strengths and challenges. In fact, they can be complementary to each other for improving Hong Kong's environment in both medium to long term as long as the costs involved, benefits generated and potential risks are made known for the community to decide upon. In our view, increasing the ratio of gas-fired generation locally in Hong Kong should be implemented as a short to medium term measure to improve Hong Kong's air quality and to mitigate climate change issues. At the same time, more studies on the feasibility of enhancing the interconnection between Hong Kong and the Mainland Grid should be conducted to see how we can best pave the way for greater infrastructure integration in the longer term. These studies should provide a better idea of the feasibility, costs, benefits and impact on local levels of reliability and emissions performance. With this information, we can make a better choice about whether, how and when we should invest in a new interconnector with the Mainland.

Thank you for your kind attention.

Yours sincerely,

Dr. Peter KK WONG SBS JP Principal President Mr. Tony CN KAN President

Dr. Eugene K K CHAN Chairman

	и- 1 ^{3/}	617B00039		
1 1 1 1 1 1		617B00039		
		Response Form	Annex	
1 I I I I I I I I I I I I I I I I I I I	Public	Consultation on Future Fuel Mix for Electricity Generation for Hon	g Kong	
	Please s	end this response form to us on or before 18 June 2014 by one of these means:		
	mail:	Environment Bureau, Electricity Reviews Division, 15/F, East Wing,		
1	Central Government Offices, 2 Tim Mei Avenue, Tamar, Hong Kong			
	e-mail: fuel_mix@enb.gov.hk			
	fax:	2147 5834		
1				
F	art 1 (s	ee Notes)		
-				
	his is a	✓ corporate response (representing the views of a group or an organisation) of	or	
1 1 1		Individual response (representing the views of an individual)		
1		by UBS		
2 7 1		(name of person or organisation)		
		at and m		
		(telephone) (e-mail)		
F	'art 2			

Fuel Mix Options

			ORT	NATURAL	COAL
	FUEL MIX	NUCLEAR (DBNPS)	GRID PURCHASE	GAS	(& RE)
	Existing (2012)	23%	-	22%	55%**
	Importing more electricity	20%	30%	40%	10%
OPTION I	the Mainland power grid	Total	: 50%		
OPTION 2*	Using more natural gas for local generation	20%	-	60%	20%

* The above fuel mix ratios aim at providing a basis for planning the necessary infrastructure for electricity supply. Flexibility should apply to actual deployment of each fuel type, having regard to the circumstances happening on the ground.

** Inclusive of a small percentage of oil

Part 3

Specific Questions for Consultation

Q1: How do you view each of the two fuel mix options with regard to safety, reliability, cost, environmental performance and other relevant considerations? (Please indicate your view on **EACH** of the two options.)

	Not Support	Reason for NOT supporting (You can tick more than one box) Safety Reliability Affordability
		 ✓ Safety ✓ Reliability ✓ Affordability
	V	 Environmental performance Others (please specify):
		Safety Reliability Affordability Environmental performance Others (please specify):
el mix opt	tions do you pre	efer? Why? (Please tick ONLY ONE box)
tick more	than one box l	pelow)
	tick more	formance

Part 4

Q2:

Other Comments and Suggestions

We see Option 1 as realistic as a short-term response. Option 2 results in significant operational and financial risks and may not achieve the HKSAR Government's environmental objectives if Hong Kong has a general interconnection to the Guangdong grid.

However Option 2 could be a worthwhile option if it was for direct connection to specific power plants (probably nuclear) in Guangdong, rather than to the the Guangdong grid. Please see the attached report for justification of this view.



未來發電燃料組合

公眾諮詢的回應文件 (行政摘要)

二零一四年六月

行政摘要

引言

 香港特區政府於二零一四年三月十九日,就香港未來發電燃料組合開展為期 三個月的公眾諮詢。港燈向政府提交回應文件,認為方案一建議由內地南方 電網引入網電,不會為本港電力供應帶來效益,只會引發很多不明朗因素。 我們相信,方案二建議增加本地天然氣的發電比例,是最好的選擇。

諮詢文件提出的兩個方案

2. 為進一步改善空氣質素及應對氣候變化, 諮詢文件提出了下列兩個方案:

方案 1- 從南方電網購買三成電力

- 方案 2- 香港增加天然氣發電比例至六成
- 我們留意到,諮詢文件就兩個方案所提供的資料,特別有關方案一的資料嚴 重不足,例如如何落實和執行向內地購買網電、對未來電費的影響,對香港 以至區內的環境影響等均欠缺全面。而方案一實際是否可行則未能判斷。
- 另外,按照《空氣污染管制條例》下相關之第二份【技術備忘錄】的要求, 本地燃氣發電將於二零一五年增至香港整體發電(包含進口核電)燃料組合的 四成,與方案二的目標距離不遠。

港燈的取態

5. 我們相信香港市民有合理的期望,要求所選擇的方案所帶來的效益,必須高於其付出之代價。因此,港燈以四個能源政策目標的角度,評估及比較兩個方案的成本效益。我們的分析清楚顯示,方案二較為可取。

對兩個方案的評估

可靠性

- 多年來香港享有世界級的供電可靠度,採用方案二提高本地發電的天然氣比
 例,對維持高度可靠的電力供應最為有效。
- 7. 相比之下,方案一從未經試行亦存在極高的不確定性,各界都非常擔心其對 香港的供電可靠度會帶來不利的影響。方案一不論在技術層面和運作、及因 聯網所帶來的系統風險等多個方面,都令人擔心;更遑論一旦出現緊急情況, 本地後備發電機組未能即時提供支援的情況。
- 即使最終可以不惜代價去減低方案一對供電可靠度的影響,公眾不禁會問, 為何香港要先接受一個較高供電風險的方案,然後再耗費大量時間、精力和 支付額外費用,去降低此風險。

環保表現

- 制訂二零二三年發電燃料組合的主要目的是為改善空氣質素及應對氣候變化, 所以任何發電燃料組合的改變,都應該建基於本地及區域性的空氣質素及溫 室氣體排放得以改善,否則便沒有理由去作出改動。
- 10. 方案二提出香港增加使用天然氣發電的比例,以代替燃煤發電。天然氣發電 帶來明顯及實質的改善,不單在香港本地,甚至大珠三角地區亦同可受惠。
- 11. 方案一只是將香港的排放物轉嫁至內地,絕對是典型的 NIMBY(不要在我家後園)心態。參考澳門從內地購電的溫室氣體排放數據,我們相信由南方電網額外供給香港的電力很大機會來自燃煤發電機組,因此不但不能改善大珠 三角地區的空氣質素,更會加劇溫室氣體排放。

合理價格

12. 我們相信方案二的電力價格將較方案一合理。基於建造工程複雜、輸電設施 對大量土地的需求以及連接廣東與香港之間輸電網絡走廊的需要,以至南方 電網、本地電力公司和各級政府之間需要廣泛商討等各種因素,方案一存在 極不確定性,亦難以準確控制工程開支及確保可以如期竣工。

- 13. 一旦採納方案一,香港將喪失議價能力,在買電時處於弱勢。方案一會令特 區政府無權監管的南方電網,成為對港供電的單一壟斷供應商。而由於香港 別無選擇,日後為應付用電需求的增長,只能持續進口網電,並接受南方電 網所控制的供電價格、質素、條款以及發電燃料組合。
- 14. 目前廣東沿岸已急速發展接收液化天然氣的基建設施,世界各地亦正向亞洲 區增加液化及管道天然氣供應,再加上南中國海多個離岸氣田亦相繼投入生 產,區內天然氣供應正穩步上升。港燈相信,天然氣價格已經由歷史高位回 落,極有可能維持在目前相對穩定的水平,甚至有進一步下調的空間。
- 15. 事實上,香港只須於二零二三年增加少於二十個百分點的天然氣發電比例已 經足以符合方案二的六成天然氣發電目標。

燃料多元化

- 16. 方案一不會令香港的發電燃料組合來源變得多元化·根據南方電網的發電燃料組合,香港未來若要購買百分之三十網電·很大機會只會來自燃煤·因此以為透過南網可以輸入環保清潔電力的想法不切實際。
- 17. 方案一並非令發電燃料來源多元化或引入潔淨能源的捷徑。港燈相信,香港 應自行承擔和履行減排的責任,而不是簡單地把責任外判予鄰近地區。

增加未來電力供應的彈性

- 18. 港燈相信,方案二在應付日後的電力需求方面更具彈性。方案一是一個非常 僵化的選擇,因為涉及龐大的基建投資及長逾十年的工程時間,未能靈活調 整購電量去應付未來對用電需求量的變化。
- 19. 反之,主張以天然氣發電去減低溫室氣體排放的方案二,則可輕易因應需求 而作出調整,因為新的天然氣機組只需四至五年便可以投產,可視乎不斷變 化的用電需要,在發電廠預留發展的土地上,按部就班興建新機組。

社會因素

20. 若香港採取方案一,本地發電的規模將會縮小,大量職位和相關業務都會流向廣東省,變相犧牲了本土的就業和經濟發展機會。如採用方案二,香港將可保留和傳承電力行業的高水平工程質量和專業技術,並可以確保對本港供電的穩定性,以達到香港作為亞洲國際都會的要求。

對二零一八年後開放電力市場檢討的影響

- 21. 方案一將不會帶來有意義的競爭。為了減低排放而增加對輸入網電的倚賴, 只會令香港未來電力市場的發展,剩下按南網定價買電的唯一選擇。屆時香 港已沒有足夠的發電能力走出這困局。
- 雖然世界上很多地區都有區域聯網,但相關的誘因及理據很明顯並不適用於
 香港。輸入網電的地區,亦往往因此而衍生不少與電力質量相關的問題。

澳門的經驗

23. 澳門有九成電力從南網輸入,然而香港無論在供電可靠度、環保表現、燃料 多元化和合理價格等各方面,都較澳門優勝。港燈認為澳門的經驗可給香港 借鏡並引以為鑑,提供令人說服的理由反對方案一。

結論

- 24. 港燈向政府提交的回應文件明確指出,在詳細考慮過政府提出的四大能源政策目標和其他相關因素後,方案二都遠較方案一優勝。
- 25. 港燈認為不宜採納方案一,因為它將會危害香港目前享有安全、可靠和穩定 的電力供應,令到溫室氣體及其他排放不減反加,而電費亦遠較方案二的預 期增幅為高。
- 26. 反之,方案二是一個循序漸進、切實可行的方案,可延續香港世界級的電力 質素,對減低溫室氣體及其他排放帶來明顯及實質的改善,而未來電費的增 幅,亦遠較方案一為温和。
- 27. 港燈建議政府採納方案二,作為香港未來發電燃料組合發展的藍本。





Submission on Future Fuel Mix for Electricity Generation

Public Consultation

June 2014

Table of Contents

Ι.	EXEC	UTIVE SUMMARY	1
н.	ENER		7
III.	THE	TWO OPTIONS IN THE CONSULTATION PAPER	14
IV.	HK E	LECTRIC'S APPROACH	
V.	ASSE	SSING THE TWO OPTIONS	
	(A)	RELIABILITY	
	(B)	ENVIRONMENTAL PERFORMANCE	21
	(C)	AFFORDABILITY	
	(D)	DIVERSIFICATION	
	(E)	FLEXIBILITY IN SCALING UP FUTURE SUPPLIES	
	(F)	SOCIAL CONSIDERATIONS	
	(G)	IMPLICATIONS FOR THE POST-2018 ELECTRICITY MARKET	
VI.	THE	MACAO EXPERIENCE	35
VII.	CON	CLUSION	

I. EXECUTIVE SUMMARY

Introduction

 The Government launched a 3-month public consultation on future fuel mix for electricity generation on 19 March 2014. HK Electric's submission is that the grid connection for electricity import under option 1 will only create uncertainties but not benefits, and that increasing local natural gas generation under option 2 represents the best way forward.

The Two Options in the Consultation Paper

- 2. To further improve air quality and combat climate change, the Consultation Paper puts forward the following two options:
 - Option 1 Purchasing 30% of total electricity demand from China Southern Power Grid Co. Ltd. (CSG)
 - Option 2 Increasing local gas generation to 60% of total electricity demand
- 3. We observe that information about the two options in general and option 1 in particular, such as how they are intended to be actually implemented, their impact on tariffs in Hong Kong and their environmental impact on Hong Kong and the region, is rather incomplete. In fact, option 1 is only a possibility which may or may not be feasible.
- 4. We further observe that, to meet the emissions control requirements under the Air Pollution Control Ordinance's Second Technical Memorandum, the proportion of natural gas in Hong Kong's overall generation fuel mix (including nuclear import) will in any event be increased to 40% by 2015, not far off from that proposed under option 2.

HK Electric's Approach

5. We believe that Hong Kong people have a legitimate expectation that the benefits of any chosen option must outweigh its costs. Accordingly, HK Electric's approach is to assess how the costs of each option weigh against its benefits in terms of the four energy policy objectives. Our cost benefit analysis clearly demonstrates that option 2 is the preferred option.

Assessing the Two Options

<u>Reliability</u>

- 6. Hong Kong has enjoyed world class electricity reliability over the years. The increased use of natural gas as fuel in local electricity generation under option 2 is best placed for the high reliability to continue.
- 7. By comparison, option 1 is untested and highly uncertain, and there are grave concerns on its possible adverse impacts on Hong Kong's supply reliability. There are serious doubts on its technical arrangements and implementation, system risks, and the non-availability of local back-up generation to cater for emergency.
- 8. Even if it will ultimately be possible for painstaking arrangements to be made to reduce the impact on reliability at additional costs, the question remains why Hong Kong should accept an option with higher reliability risk and then incur a great deal of effort and costs to reduce such risk.

Environmental Performance

- 9. The primary objective of revamping fuel mix in 2023 is to improve air quality and combat climate change. Any change in fuel mix must result in improvements in air quality and greenhouse gases (GHG) emissions, both locally and regionally, or otherwise there is no justification for making the change.
- 10. Option 2 increases local gas generation to replace coal generation, bringing certain and measurable benefits to emissions reduction not only in Hong Kong but also in the Greater Pearl River Delta (GPRD) region.
- 11. Option 1 is merely a transfer of emissions from Hong Kong to the mainland, or the typical "not-in-my-backyard" (NIMBY) approach. With reference to GHG emissions of the grid power purchased by Macao, we believe that the additional generation for meeting the proposed grid power requirement to Hong Kong will most likely come from coal. Not only will there be no improvement to the air quality in the GPRD, but GHG emissions will increase.

<u>Affordability</u>

- 12. We believe that option 1 is less affordable than option 2. The engineering complexity, the huge demand for land and the requirements for transmission corridor in both Guangdong and Hong Kong, together with the need for extensive negotiations amongst CSG, the power companies in Hong Kong and the different levels of governments will give rise to significant project uncertainties, likely leading to unmanageable time and cost over-run.
- 13. Under option 1 Hong Kong will be in a very poor position to bargain for fair, reasonable and competitive import prices. The option will effectively make CSG a monopolistic grid supplier not subject to the Government's scrutiny. On the other hand, Hong Kong will become a captive buyer which has no choice but to continue to import grid electricity to satisfy its demand at grid supply prices, quality, terms and fuel mix controlled by CSG.
- 14. The rapid gas infrastructure development along the Guangdong coast, the increasing LNG and piped gas supply to Asia, and the commencement of off-shore gas field production in the South China Sea all have the effect of increasing natural gas supply. Gas prices have come down from their historical peaks and will likely be stabilized at the present level with room for further reduction.
- 15. In fact, the required increase in local gas generation will only be around 20 percentage points to meet the 60% target set out for option 2 by the Government in 2023.

Diversification

- 16. Option 1 does not assist in diversifying Hong Kong's fuel mix. Based on CSG's fuel mix, the fuel to generate the electricity for supply to Hong Kong is most likely to be coal, and any notion of tapping into cleaner fuel sources is no more than illusory.
- 17. Option 1 cannot be seen as a short-cut to diversification or greener energy. HK Electric believes Hong Kong should act on its own commitment to combat climate change, rather than outsourcing it to our neighbours in the region.

Flexibility in Scaling up Future Supply

- 18. HK Electric considers that option 2 provides greater flexibility in scaling up future supply. Option 1 is a very rigid choice in adapting to changes in future demand, due to its huge infrastructure investment and the long lead time required for the construction which can easily take more than 10 years. Consequently, there is little flexibility to scale up or down future supply of imported electricity.
- 19. On the other hand, option 2, which relies on local gas generation to curb carbon emission, can easily adapt to changes in future demand since the new gas fired units, with much shorter lead time of four to five years, can be installed at the power stations on the previously allocated land on a gradual unit-by-unit basis in response to the dynamic demand condition.

Social Considerations

20. If Hong Kong is to go for option 1, it will be reducing the scale of local generation. Jobs and businesses will be sent to Guangdong at the expense of local employment and the economy. Under option 2, engineering and technical skills specializing in the safe operation of generation units will be retained in Hong Kong to ensure high supply reliability that is expected of Hong Kong as Asia's world city.

Implications for the Post-2018 Electricity Market

- 21. Option 1 will not bring about any meaningful competition. The increasing reliance on grid import to reduce local emissions will only force the Hong Kong electricity market to end up with a single bulk supply from CSG at a price it dictates. By then, Hong Kong will not have sufficient local capacity to walk out of the arrangement.
- 22. While grid interconnections are common in many jurisdictions, their drivers or justifications are absent in Hong Kong. Even for those jurisdictions which import grid electricity, they have often faced problems associated with power quality created by the grid interconnection.

Macao Experience

23. Hong Kong has outperformed Macao in terms of reliability, environmental performance, diversification and affordability. 90% of Macao's electricity is in fact imported electricity from CSG supplied by coal generation in Guangdong. The Macao model presents a convincing case against option 1.

Conclusion

- 24. HK Electric's submission clearly demonstrates that option 2 prevails over option 1 when assessed against the Government's four energy objective perspectives and all other considerations.
- 25. We firmly believe option 1 will endanger Hong Kong's supply of safe, reliable and reasonably priced electricity and will increase (rather than decrease) GHG and other emissions, with tariff impact being much more significant than that under option 2. There is no case for a choice of option 1.
- 26. On the contrary, option 2 is a flexible and workable option that allows for gradual changes and is proven to be able to maintain Hong Kong's world class electricity supply record. It is expected to bring about visible and measurable environmental improvements to reduce regional GHG and other emissions and the tariff impact will be far less substantial compared with that under option 1.
- 27. HK Electric's recommendation is that the Government should adopt option 2 as the blueprint for Hong Kong's future fuel mix for electricity generation.

II. INTRODUCTION

- The Hong Kong SAR Government (the Government) launched a 3-month public consultation on future fuel mix for electricity generation on 19 March 2014. The Hongkong Electric Company, Limited (HK Electric) is pleased to provide our submission in response to the Consultation Paper.
- HK Electric has been supplying electricity to Hong Kong Island for over 120 years, and is committed to safely providing a reliable, efficient and adequate electricity supply to our customers. Our customers and other stakeholders expect this commitment to continue.
- 3. A reliable electricity supply with reasonable prices is critical to Hong Kong. However, Hong Kong also recognizes its role in the universal effort to combat climate change. The Public Consultation provides an opportunity for Hong Kong to contribute to this initiative, and to path its future of greener fuel source. HK Electric welcomes this opportunity to provide our input.
- 4. In approaching the Consultation Paper our focus is the interests of Hong Kong as a whole going forward. We are keen to ensure that the achievement of the power sector can continue, and that Hong Kong people will continue to enjoy quality and affordable electricity service.
- 5. The Consultation Paper puts forward two options involving grid electricity import and increasing local natural gas generation respectively. In our submission, HK Electric will explain that the grid connection for electricity import under option 1 will only create uncertainties but not benefits, and that increasing local natural gas generation under option 2 represents the best way forward.

II. ENERGY POLICY OBJECTIVES

Energy Policy Objectives

6. The Government's energy policy is:

"to ensure that the energy needs of the community are met safely, reliably, efficiently and at reasonable prices, while minimizing the environmental impact of electricity generation.¹"

- 7. In accordance with this energy policy, the Government identifies four guiding energy policy objectives in the Consultation Paper. They are:
 - safety;
 - reliability;
 - affordability; and
 - environmental performance².
- 8. HK Electric has always been supporting these energy policy objectives to ensure that electricity can be provided reliably and safely to consumers at reasonable prices and with minimum environmental impacts. We fully recognize the pivotal role of the Scheme of Control Agreement, to which HK Electric is subject, plays in promoting these objectives. We believe our performance record speaks well for itself.

<u>Safety</u>

9. The Government ranks safety as the top priority:

"... our objective is to ensure that electricity is generated, transmitted, distributed and used in a safe manner.³"

10. Hong Kong has every reason to be proud of its safe electricity supply. The Government has enacted legislations, regulations and codes of practice, pursuant to which activities across the supply and consumption chain are monitored and regulated to ensure safety. The two power companies in Hong Kong are directly

¹ Consultation Paper, p 2

² Consultation Paper, p 4 to 5

³ Consultation Paper, p 4

accountable to their customers and the public for the safety of their respective electricity systems.

11. The regulatory framework and the industry's efforts have paid off. The two power companies have not seen any major accidents over the years, and this has translated into their high electricity supply reliability to which we will turn next.

<u>Reliability</u>

12. The Government notes:

"As an international financial and commercial centre operating in a densely populated environment with a significant concentration of high-rise buildings (domestic and non-domestic), Hong Kong cannot afford any instability in electricity supply. A reliable energy supply is essential not only to support and drive economic activities and development but also to ensure safety of the general public.⁴"

- 13. HK Electric shares these views. As one of the most densely populated vertical cities in the world and an international financial hub, the importance of reliable electricity to Hong Kong cannot be emphasized enough. Hong Kong has high-density and high-rise living and a heavy reliance on elevator and mass transit transportation needs; air-conditioning is considered by many to be crucial; computer and control systems are indispensible to its financial and commercial activities; and telecommunications is essential for connecting people. There is without a doubt that electricity has penetrated into every aspect of our daily lives, and is critical to the lifestyle and business environments of Hong Kong.
- 14. The Government further states:

"Hong Kong enjoys a highly reliable electricity supply. Reliability exceeds 99.999%, which surpasses those of many other large cosmopolitan cities.... The high degree of electricity supply reliability in Hong Kong should not be taken for granted.⁵"

15. Hong Kong's two power companies have been planning, building and operating their generating plants and networks to the highest international standards to suit Hong

⁴ Consultation Paper, p 4

⁵ Consultation Paper, p 4

Kong's local environment. These endeavors have led Hong Kong to be one of the few cities in the world with top electricity supply reliability for many years. Indeed, World Economic Forum in its Global Competitiveness Report 2013-2014, has ranked Hong Kong as number 1 among 148 economies in respect of electricity supply quality (Figure 1).

	WORLD	2.07	Quality of electricity supply	y			
Invictif Report	COMMUTED TO INFERIOR WORLD	In your country, how would you assess the reliability of the electricity supply (lack of interruptions and lack of voltage fluctuations)? [1 = not reliable at all; 7 = extremely reliable] I 2012–I3 weighted average					
The Global		RANK	COUNTRY/ECONOMY	VALUE	1	MEAN 4.5	1
Competitiveness	Report	1	Hong Kong SAR	6.8			
2013-2014		2	Switzerland	6.8			
aus Schwab, World Economic Forum		3	Netherlands	6.7			
		4	Austria	6.7			
		5	Finland	6.7			
		6	Denmark	6.7			
		7	Iceland	6.7			
		8	Singapore	6.7			
		9	United Kingdom	6.7			
		10	France	6.6			

Figure 1: World Economic Forum's "The Global Competitiveness Report 2013-2014", cover and p 438 (excerpt)

16. For HK Electric, we have sustained a reliability rating in excess of 99.999% since 1997, and our average power interruption recorded is of a world-class standard of less than 1 minute per customer per year (Figure 2).

Operation	2013	2012	2011
Reliability			
Electricity supply reliability (%)	>99.999	>99.999	>99.999
Unplanned customer minutes lost (minutes)	0.7	0.7	0.7

Figure 2: HK Electric's supply reliability ratings 2011 – 2013 ⁶

Hong Kong people expect the highest reliability standard to be maintained at all times.
 We simply cannot afford to compromise on the reliability of our electricity supply.

⁶ HK Electric Investments' Sustainability Report 2013, p 43

Environmental Performance

18. The Consultation Paper identifies concerns for local, regional and global environment as key reasons to review and plan ahead the fuel mix in Hong Kong. The Government states:

"... we have to meet the air pollutant emission reduction targets already set to improve our air quality, both locally and regionally; and we remain committed to the carbon intensity reduction target proposed during the public consultation on Hong Kong's climate strategy and action agenda in 2010. This helps to reduce Hong Kong's greenhouse gas (GHG) emissions so that we can articulate a path forward in contributing to the global fight against climate change.⁷."

- 19. HK Electric supports the Government's environmental objectives. The Air Pollution Control Ordinance (APCO) framework regulates and scrutinizes the life-cycle of power sector's environmental performance from planning, construction, operation and retirement of local generation facilities. As explained in the Consultation Paper, the emission caps have been progressively tightened and, through the Second and subsequently the Third Technical Memoranda under the APCO, the emission caps for the power sector from 2017 onwards will be reduced by 39% to 59% as compared to the 2010 levels⁸. In addition, the Hong Kong power sector has devoted great efforts and made encouraging achievements in emission improvement under the Scheme of Control framework.
- 20. Following a host of environmental initiatives including natural gas generation, renewable energy (RE) and addition of flue gas desulphurization and low nitrogen oxides (NOx) burner systems, HK Electric's emissions of sulphur dioxide (SO₂), NOx and respirable suspended particulates (RSP) have been substantially reduced by ~40% to ~90% in the past five years from 2008 to 2013 (Figure 3).

Consultation Paper, p 11

⁸ Consultation Paper, p 13



Figure 3: HK Electric's emissions reduction performance 2008 – 2013

- 21. There is no end to the global fight against climate change, and there is no room for complacency. Despite all these environmental efforts, more needs to be done. The outcome of the Public Consultation should give Hong Kong a roadmap on how to continue its fight in this battle.
- 22. Hong Kong recognizes its role in improving local and regional air quality. We should continue to strive for air quality improvement and do our part to combat climate change.

Affordability

23. The two power companies are privately owned, and operate without any government subsidies. Though with no indigenous fuel, their prevailing tariffs are well below those of other metropolitan cities including Singapore, Tokyo, Sydney, London and New York⁹ (Figure 4). In fact, the tariffs in Hong Kong are internationally competitive and affordable, and account for only 1.77% of the average total household expenditure¹⁰ (Figure 5).

⁹ Consultation Paper, p 6, Figure 5

¹⁰ Census & Statistics Department's "2009/10 Household Expenditure Survey and the Rebasing of the Consumer Price Indices"







Figure 5: Breakdown of Household Expenditure (Composite CPI Expenditure Weights)

24. For HK Electric, the aggregate tariff adjustment from 2008 to 2013 was only 5.9%, which was significantly lower than the 18%¹¹ overall inflation - measured by composite consumer price index (CCPI) - in Hong Kong for the same period (Figure 6).



Figure 6: Comparison of HK Electric's net tariff and Composite CPI (Headline) 2008 – 2013

- 25. Barring unforeseen circumstances, HK Electric expects its net tariff in the five years up to 2018 to remain unchanged¹².
- 26. Hong Kong has been enjoying safe and reliable electricity with minimal impact on the environment at affordable prices.

 ¹¹ Census & Statistics Department's "Monthly Report on the Consumer Price Index" (April 2012 & April 2014)
 ¹² UK Electric's proceeded of 10 December 2012

¹² <u>HK Electric's press release of 10 December 2013</u>

III. THE TWO OPTIONS IN THE CONSULTATION PAPER

The Two Options

- 27. In 2012 Hong Kong's energy mix comprised coal (and renewable energy (RE)), imported nuclear energy and natural gas at 55%, 23% and 22% respectively. As required by the Second Technical Memorandum under the APCO and the Air Quality Objectives (AQO), the emission caps for the two power companies will be further tightened through increased natural gas generation, with the projected fuel mix in 2015 to be coal (and RE), imported nuclear energy and natural gas at 40%, 20% and 40% respectively.
- 28. To further improve air quality and combat climate change, the Consultation Paper puts forward the following two options¹³:
 - Option 1 Purchasing 30% of total electricity demand from China Southern Power Grid Co. Ltd. (CSG)
 - Option 2 Increasing local gas generation to 60% of total electricity demand
- 29. Figure 7 summarizes the fuel mix under the two options in the Consultation Paper and how they compare with Hong Kong's fuel mix in 2012 and projected fuel mix in 2015.

FUEL MIX		NUCLEAR GRID		GAS	COAL (& RE)
		(DBNPS)	FORCHASE	220/	55%**
	Importing more electricity	23%	-	22.70	55%
OPTION 1*	through purchase from	20% 30%		40%	10%
	the Mainland power grid	Total : 50%			
OPTION 2*	Using more natural gas for local generation	20%	-	60%	20%
Projected 2015 Fuel Mix	Second Technical Memorandum under Air Pollution Control Ordinance (Cap. 311) and Air Quality Objectives	~20%	-	~40%	~40%
* The above f supply. Flexi happening or	uel mix ratios aim at providing a bility should apply to actual deplo n the ground.	basis for planni byment of each f	ng the necessary uel type, having i	regard to the c	for electrici



¹³ Consultation Paper, p 31

Our Observations

- 30. The following general observations can be made about the two options put forward in the Consultation Paper:
 - (a) Information about the two options in general and option 1 in particular, such as how they are intended to be actually implemented, their impact on tariffs in Hong Kong and their environmental impact on Hong Kong and the region, are unfortunately rather incomplete in the Consultation Paper.
 - (b) Option 1 is only a possibility which may or may not be feasible. On many occasions the Government has accepted that more information about option 1 can only be available at a later stage when detailed studies and discussions with CSG and other relevant parties have been carried out. For instance, the Consultation Paper only asserts that the future generation costs under both options will be roughly the same, but without any elaboration or justification. With feasibility on option 1 remains to be studied, we cannot help questioning the accuracy of this assertion and, as will be explained below, our view on the tariff impact of both options is different from that of the Government.
- 31. The First Technical Memorandum under the APCO came into effect from 2010 and the Second and the Third Technical Memoranda will come into force in 2015 and 2017 respectively. In order to cope with these APCO's requirements, the proportion of natural gas in Hong Kong's generation fuel will in any event be increased to 40% by 2015 and to an even higher level by 2017. Accordingly, the required increase for natural gas generation under option 2 will actually be less than 20 percentage points.



Figure 8: Share of natural gas in Hong Kong's overall electricity generation fuel mix and emission caps of air pollutants for local power plants (Consultation Paper, p 13, Figure 7)

- 32. HK Electric shares a number of key concerns which are repeatedly voiced by our shareholders, customers and other stakeholders during the consultation period, such as:
 - Will importing electricity affect power supply reliability?
 - What are the costs of imported electricity?
 - What is the fuel source of the imported electricity, and in particular is it from green source?
 - Is CSG ready to supply electricity to Hong Kong?
 - What actually are the arrangements to import electricity? Can it be done in time by 2023 for Hong Kong to meet its carbon reduction targets?
 - Does electricity import help to introduce competition to the benefit of consumers?

IV. <u>HK ELECTRIC'S APPROACH</u>

- 33. The Government describes the four energy policy objectives of safety, reliability, affordability, environmental performance as competing objectives, in that the achievement of one may come at the expense of another¹⁴. HK Electric concurs with this reality.
- 34. The Government further identifies four other considerations, being diversification, flexibility in scaling up future supply, social implication and implication for the post-2018 electricity market, which may have longer-term implications on Hong Kong's electricity landscape¹⁵.
- 35. We believe that Hong Kong people have a legitimate expectation that the benefits of any chosen option must outweigh its costs. Accordingly, HK Electric's approach is to assess how the costs of each option weigh against its benefits in terms of the four energy policy objectives.
- 36. Our cost benefit analysis clearly demonstrates that option 2 is the preferred option.

¹⁴ Consultation Paper, p 8

¹⁵ Consultation Paper, pp 36 to 37

V. ASSESSING THE TWO OPTIONS

(A) <u>RELIABILITY</u>

- 37. Hong Kong has enjoyed world class electricity reliability over the years. The increased use of natural gas as fuel in local electricity generation under option 2 is best placed for the high reliability to continue.
- 38. By comparison, option 1 is untested and highly uncertain, and there are grave concerns on its possible adverse impacts on Hong Kong's supply reliability. The doubts over option 1 are considered from technical and practical perspectives below.
- 39. Even if it will ultimately be possible for painstaking arrangements to be made for option 1 to reduce the impact on reliability at additional costs, the question remains why Hong Kong should accept an option with a higher reliability risk and then incur a great deal of effort and costs to reduce such risk.

Technical Uncertainties

40. The Consultation Paper states:

"Subject to further feasibility studies of the detailed technical issues involved in importing more electricity from the mainland, including the necessary arrangements to ensure reliable supply to Hong Kong in case of emergency, our assessment is that it is technically feasible for Hong Kong to import more electricity from the mainland.¹⁶"

41. HK Electric believes that option 1 was put forward without an adequate appreciation of the technical arrangements to import massive amount of electricity and the hurdles that Hong Kong will need to overcome in order to address the adverse impact on supply reliability. Option 1, being a possibility only, may or may not be workable.

¹⁶ Consultation Paper, p 33

42. The 30% electricity proposed to be imported under option 1 is very significant and amounts to 15 billion units of electricity, which is even greater than the total amount of hyrdo power transmitted from the Three Gorges to the entire Guangdong province¹⁷. There are complex issues of system stability and capacity adequacy, as explained below, to ensure reliability. There can be no assurance that technical solutions will indeed be available to address the reliability risks, and even if there are, serious doubts still prevail as to whether CSG can or will take measures to reinforce its grid to meet the high supply reliability expected from Hong Kong. Such measures will require co-operation from CSG and different mainland government levels and will be beyond Hong Kong's control. Moreover, it is questionable whether CSG can acquire sufficient land necessary for the reinforcement works from the rapid developing urban areas of Guangdong in the vicinity of Hong Kong.

System Risks

- 43. A system with extensive interconnection is exposed to higher risk of faults and supply incidents due to the increase in size and complexity. Wide-area interconnection is known to be prone to system disturbances, which can result in cascading power interruptions or even massive blackouts affecting millions of customers for hours or even days. It is only after the "lights go out" when it is recognized that blackouts can actually happen and that the consequence can be very severe. For instance, the US-Canada blackout in 2003 during which 50 million people were left without electricity for many days¹⁸, and the 2012 blackout in India affecting 670 million people for more than a day¹⁹ readily come to mind as examples for illustration.
- 44. CSG's service area covers one million square kilometres, with a population of 230 million. The grid transmits electricity through its huge and complex overhead line network spanning over thousands of kilometres in five southern provinces of mainland China, namely Guangdong, Guangxi, Yunnan, Guizhou and Hainan, some parts of which are exposed to extreme weathers, typhoons, thunderstorms or other natural disasters. For example, due to a severe drought in Yunnan, Guizhou and Guangxi in 2010, which lasted for over 200 days, Guangdong had exported 320 million

¹⁷ 《南方電網 2012 年電力供應情況及 2013 年電力供需形勢分析報告》(CSG Electricity Supply Report 2012 and Electricity Supply-demand Analysis Report 2013), p 9 - the amount of hyrdo power transmitted from the Three Gorges to Guangdong is 13.66 billion units

¹⁸ US-Canada Power System Outage Task Force: "<u>Final Report on the August 14, 2003 Blackout in the United States and Canada: Causes and Recommendations</u>"

¹⁹ "India's Grid Chief Shifts Blame for Blackouts" (Wall Street Journal, 17 August 2012)

units of electricity to Yunnan²⁰. Any disturbance arising from parts of CSG's grid can put local supply reliability at serious risk. For instance, a snow storm in 2008 brought about power interruptions which affected six million households in 99 counties (or 26.18 million people) within CSG's service territory²¹, and 545 counties/districts in 37 cities of 10 provinces within State Grid's service territory²²; and in some cases the power interruption lasted for as long as 21 days²³. A recent example was a heavy rainstorm in May 2014 which caused multiple circuit trippings, with power suspension affecting 248,000 customers mainly in Shenzhen, Dongguan, Jiangman, Yangjiang, Zhongshan, Zhuhai and Heyuan, amongst which Shenzhen was hit most seriously²⁴. On average, urban customers of CSG faced an outage time ranging from 1 hour to 3.2 hours in 2012 (Figure 9).



Figure 9: Average annual power interruption time per CSG's urban customer in 2011 & 2012

²⁰ <u>CSG 2010 Corporate Social Responsibility Report</u>, p 11 - 12

²¹ <u>CSG 2008 Corporate Social Responsibility Report</u>, p 11

²² <u>State Grid 2008 Corporate Social Responsibility Report</u>, p 17

²³ 「<u>浙江因雪災停電鄉鎮恢復供電</u>」 (Sina News, 17 February 2008)

²⁴ 「<u>特大暴雨突襲</u> 電網僅受 "微創"」(南方電網報 (CSG News), 13 May 2013);「 <u>南方電網全面恢復</u> 廣東省受暴雨影響客戶供電」(中國電力網 (China Power), 15 May 2014)

²⁵ CSG 2012 Corporate Social Responsibility Report, p 15
- 45. Owing to the geographical proximity and lifestyle similarity, the demand in Guangdong and that in Hong Kong peak at around the same time. Guangdong's installed capacity is still insufficient to meet its maximum demand, and the province is heavily reliant on sufficient electricity import (including importing from CLP Power) to maintain its own supply adequacy.
- 46. In case of any mishaps on electricity import to Guangdong (such as Yunnan's drought in 2010²⁶), there may not be sufficient supply to meet the electricity demand of both Guangdong and Hong Kong, and competition or rationing may become necessary. Option 1 will put Hong Kong's supply security in serious jeopardy.

Local Back-up Generation Availability

- 47. The Consultation Paper puts forward back-up generation capacity, and in particular extending the useful life of existing power plants, as a possibility to cater for emergency. However, it provides no information on how the back-up provision can be achieved or on the cost implications.
- 48. It is unrealistic to assume that the existing ageing coal generation units in Hong Kong can be kept for back-up support, as their useful lives cannot be extended indefinitely. Any back-up capacity will require a team of operators for routine maintenance and on-call operation, and spare parts and fuel stock will need to be kept, such redundancy being wholly uneconomical.
- 49. Regardless of the type of standby generating plants Hong Kong can provide, restoring 30% of electricity supply from an interruption, even assuming the remaining 70% Hong Kong supply could survive and there are readily available generating plants with the required capacity, can easily take hours if not days. There can be no assurance that the backup provision will be able to provide relief to an emergency in a timely manner to maintain Hong Kong's electricity supply.

(B) ENVIRONMENTAL PERFORMANCE

50. The primary objective of revamping fuel mix in 2023 is to improve air quality and combat climate change. Any change in fuel mix must be able to result in solid,

²⁶ <u>CSG 2010 Corporate Social Responsibility Report</u>, p 11 - 12

quantifiable and verifiable improvements in air quality and in GHG emissions, both locally and regionally, or else there is no justification for making the change.

- 51. Option 2 increases local gas generation to replace coal generation. Gas generation will reduce carbon dioxide (CO₂) emission by roughly half compared against that of coal generation, with also significant reductions in SO₂, NOx and RSP emissions. Though the use of natural gas will not reduce carbon emissions entirely, it can bring certain and measurable benefits to emissions reduction not only in Hong Kong but also in the GPRD region. The pace of improvement is entirely in the hands of Hong Kong and can always be planned and implemented to allow flexibility.
- 52. We see option 1 as merely a transfer of emissions from Hong Kong to the mainland. We believe that the air quality in the GPRD region will actually suffer with this option for the reasons stated below, and our view is that only option 2 can bring about a real improvement in environmental performance.

Fuel Source for Grid Import

- 53. Power system operation usually dispatches generation units based on the different characteristics of generation sources and their economic and environmental merits. For instance, RE cannot be stored; hydro power can be stored temporarily but not for long; nuclear energy has to be generated in a rigid fashion with its output kept constant as long as possible... etc.
- 54. The grid hence requires nuclear energy and RE (e.g. wind or hydro) to be dispatched as base generation and low-efficiency highest polluting coal energy to be dispatched as the lowest-priority. In effect, therefore, the nuclear energy and RE will be fully consumed regardless of whether Hong Kong imports any electricity from CSG.
- According to its 12th 5-year Plan, Guangdong will increase its coal generation capacity by about 50% between 2010 and 2015²⁷ (Figure 10). By 2015 over 60% of CSG's grid electricity will be generated from coal in Guangdong.

²⁷ 廣東省發改委《廣東省能源發展"十二五"規劃》(The 12th 5-year Energy Development Plan of Guangdong Province, NDRC (Guangdong Province)); 廣東省發改委《廣東省國民經濟和社會發展報告 (2013)》(The National Economic and Social Development Report of Guangdong Province (2013), NDRC (Guangdong Province))



Figure 10: Guangdong's estimated fuel mix (installed capacity) in 2010 and 2015²⁴

56. The majority of CSG's clean energy profile is from hydro power generated and transmitted from Yunnan, Guizhou, and Three Gorges. These regions are inclined to reserve the clean and economical hydro power for their own developments and to restrict the amount available for export. In addition, the hydro power generating facilities are more than a thousand kilometers away from Hong Kong. To import such clean energy to Hong Kong over such a long distance will be technically challenging, and will result in significant transmission congestion and loss. Moreover, rising concerns in the environmental and ecological impact of large dammed hydro power has hindered its development and made the selection of appropriate sites more challenging²⁸. Hydro power output is also restricted by the amount of rainfall. The combination of these factors contributes to an intense demand for hydro power. For wind and solar energy, as their generation availability cannot be guaranteed and so is their output. For nuclear energy, selecting suitable sites for new nuclear power stations has become increasingly difficult, as the site must not be near seismic zone or densely populated region²⁹. The scarcity and national policy priority of nuclear energy and RE is an additional reason why they will be fully utilized before any electricity is available for export.

²⁸ 「水電開發困境如何破局」 (中國能源報 (CN Energy), 12 May 2014)

²⁹ 「乾旱和地震對中國核計劃構成"巨大風險"」(中外對話 (China Dialogue), 27 February 2013)

57. In order to ascertain the actual fuel source of the electricity for import to Hong Kong, we need to apply the concept of "<u>Marginal Fuel</u>", that is the additional fuel to be used to meet the additional demand. Based on the grid's energy dispatch arrangement³⁰, the additional generation for meeting the proposed grid power requirement to Hong Kong will most likely come from coal (Figure 11).



Figure 11: Guangdong's electricity demand profile on a typical summer day and electricity generation dispatch priority

58. With reference to GHG emissions data from Macao, we believe that the additional generation for meeting the proposed grid power requirement to Hong Kong will most likely come from coal. Not only will there be no improvement to the air quality in the GPRD, but GHG emissions will increase³¹.

³⁰ 國家發改委發佈《節能發電調度辦法》 (NDRC's Energy-efficient Generation Dispatching Guideline); 「人民日報:廣東電網實施節能發電調度」(CSG News, 19 June 2013)

³¹ Refer to Chapter VI of this submission

Outsourcing Emissions

59. Climate change is a global problem, as we all share a common air-shed and one planet. On a regional level, Guangdong and Hong Kong are in the same air-shed and Hong Kong is affected by emissions from Guangdong and beyond³² (Figure 12). If emissions are to be reduced, genuine reductions must be made.



Figure 12: Land-sea breeze trapping effect in the HK-Macao-PRD region (Environment Bureau's "A Clean Air Plan for Hong Kong" (March 2013), p 4, Figure 1)

60. In contrast to the increased gas generation under option 2 which reduces emissions, option 1 is merely a transfer of emissions from Hong Kong to the mainland, or the typical "not-in-my-backyard" (NIMBY) approach. This goes against the Government's energy objective of improving local and regional air quality and the sustainability principle of self-sufficiency. The coal fuel for the imported electricity will not reduce emissions in the air-shed common to Guangdong and Hong Kong, and ultimately Hong Kong will still be affected. The outsourcing will forego Hong Kong's opportunity for additional natural gas generation to improve regional air quality and deprive Guangdong of its much needed opportunity to clear its city smog problem.

³² Environment Bureau's "<u>A Clean Air Plan for Hong Kong</u>" (March 2013), p 5

(C) <u>AFFORDABILITY</u>

- 61. The Consultation Paper estimates that, for option 1, the unit cost of imported grid electricity will roughly double the unit generation cost over the five years from 2008 to 2012³³. Similar to the unit cost of imported grid purchase, the unit cost of additional gas-fired electricity for option 2 is also estimated to be roughly double the unit generation cost over the five years from 2008 to 2012³⁴.
- 62. The Government hence states that "as the price differential between the two options is not substantial, cost should not be a major consideration in assessing the two proposed fuel mix options.³⁵" Since this statement is neither elaborated nor justified, its validity and accuracy are questionable.
- 63. We believe that option 1 is less affordable than option 2. It will be difficult to bargain for the prices of the imported grid electricity, and the infrastructure costs for the interconnection with CSG grid will be substantial, not to mention the additional costs/charges for wheeling, load management, transmission loss, and local backup. Based on today's costs we estimate the import price alone to range between HK\$1 to HK\$1.10³⁶. Our view is that option 1 is less affordable than option 2:

Capital investment on cross-boundary transmission infrastructure

- 64. Option 1 requires building cross-boundary transmission link and other infrastructure which are estimated to cost around HK\$ 30 billion, taking into consideration the cost of submarine cables required for such a long transmission distance from Guangdong to Hong Kong between 50 to 100 km, the cost of land, and the engineering, procurement and construction (EPC) costs of other infrastructure (Figure 13).
- 65. This huge upfront capital investment will not be able to secure the necessary financing and will not be economically viable without government guarantee and long term power purchase agreement.

³³ Consultation Paper, p 35

³⁴ Consultation Paper, p 35

³⁵ Consultation Paper, p 35

³⁶ Based on Macao's import price of approximately HK\$0.8 plus infrastructure costs of approximately HK\$0.3



Figure 13: Comparison of electricity transmission routes for grid power import from Zhuhai to Macao and from Guangdong to Hong Kong

66. The engineering complexity, the huge demand for land and the transmission corridor requirements both in Guangdong and Hong Kong, together with the need for extensive negotiations amongst CSG, the power companies and the different levels of governments will give rise to significant project uncertainties and will likely lead to unmanageable time and cost over-run. It is worth noting that the construction of the huge infrastructure may in turn lead to other environmental and social issues.

Monopolistic Grid Electricity Supplier

- 67. Under option 1 Hong Kong will be in a very poor position to bargain for fair, reasonable and competitive electricity import prices. The option will effectively make CSG a monopolistic grid supplier and Hong Kong a captive buyer which has no choice but to continue to import grid electricity to satisfy its demand at grid supply prices, quality, terms and fuel mix controlled by CSG. CSG will not be subject to any Scheme of Control or any other types of scrutiny by the Government, and will not be obliged to consider Hong Kong's local conditions or policies. Moreover, the grid purchase price will be subject to currency fluctuation.
- 68. The import of fresh water from Dongjiang to Hong Kong and the import of electricity from Guangdong to Macao illustrate what we may face in the future when importing electricity. For Hong Kong the imported water price has increased by around 27%

from 2009 to 2013^{37} and for Macao the imported electricity price has increased also by 27% from 2008 to 2013^{38} . Neither Hong Kong nor Macao has any say at all.

Gas Price and Tariff Impact

- 69. Over the past few years the block increase in natural gas for replacing coal generation has put pressure on tariff. Since Hong Kong had to increase the proportion of gas generation from ~22% in 2012 to ~40% in 2015 to meet regional air quality improvement requirement, new gas supply had to be secured on the basis of the prevailing Asian gas market pricing mechanism which was linked to international oil prices. Asian gas prices have since stabilized even though Japan has shut down all of its nuclear power stations after the 2011 Fukushima incident.
- 70. The gas pricing mechanism in Asia is changing towards a more competitive direction. The new long term liquefied natural gas (LNG) supply prices secured by Japan and South Korea, both Asian price setters together taking up over half of the global LNG supplies, help to increase the bargaining power for other Asian buyers to decouple gas prices under new supply contracts from oil prices. The rapid gas infrastructure development along the Guangdong coast around Hong Kong, the increasing LNG and piped gas supply to Asia, and the commencement of off-shore gas field production in the South China Sea all have the effect of increasing natural gas supply in the region. Gas prices have come down from their historical peaks and will likely be stabilized at the present level with room for further reduction³⁹. It should also be borne in mind that CSG is similarly subject to any price fluctuation for the gas portion of its fuel mix.
- 71. In fact, Hong Kong will be able to meet the emission and carbon intensity targets in 2020 by improving the local generation mix as planned by the Government. By 2015 Hong Kong will in any case has to generate around 40% of its electricity from gas to meet the new air quality objective. Accordingly, the required increase in local gas generation under option 2 is expected to be less than 20 percentage points to meet the 60% target in 2023. For HK Electric, the unit cost of additional gas-fired

³⁷ Replies to Initial Questions raised by Finance Committee Members in examining the Estimates of Expenditure 2014-15, <u>Reply Serial No DEVB(W)127</u>

³⁸ 澳門特別行政區能源業發展辦公室 2008 年第 2 季及 2013 年第 4 季能源及服務綜合資料 (Energy and services information for Quarter 2 of 2008 and Quarter 4 of 2013, the Office for the Development of the Energy Sector, Macao SAR) (<u>http://www.gdse.gov.mo/gdse_big/newsDetails.asp?newsIndex=414</u>)

³⁹ International Energy Agency's "<u>World Energy Outlook 2013 Factsheet</u>"; Bloomberg New Energy Finance's "H1 2014 Global LNG Market Outlook; "<u>Natural gas prices 'on downward trend'</u>" (Bangkok Business Brief, 6 June 2014)

electricity will in fact be much lower than that of imported grid purchase taking into account the capital costs for installing one additional gas-fired unit and the related fuel costs. HK Electric believes that the increase in generation costs on its customers under option 2 is likely to be in low double-digit percentage rather than doubled as estimated in the Consultation Paper.

(D) **DIVERSIFICATION**

- 72. Having considered the merits of both options against the energy policy objectives of reliability, environmental performance, affordability, and demonstrating that option 2 prevails over option 1 for all these objectives, we will consider below how the two options compare with each other for the other considerations identified in the Consultation Paper, starting with diversification.
- 73. In the Consultation Paper the Government states that:

"As compared to importing more nuclear electricity through dedicated transmission line, we consider that purchase from the grid will allow Hong Kong to gain access to multiple sources of supply on a grid-to-grid basis, thereby enabling us to achieve a higher degree of fuel diversification. This option also allows Hong Kong to tap into clean fuel sources otherwise not available to us, e.g. hydro power.⁴⁰"

- 74. HK Electric is of the view that option 1 does not assist in diversifying Hong Kong's fuel mix. Based on CSG's fuel mix, the fuel to generate the electricity for supply to Hong Kong is most likely to be coal, and any notion of tapping into cleaner fuel sources is no more than illusory as explained below.
- 75. Under the usual grid-to-grid purchase arrangement, the purchaser has no control over the actual generation sources and there can be no guarantee that the imported power is clean. The reality is that Hong Kong is unlikely to tap into any of CSG's clean generation sources in the coming decades and for so long as there is a genuine need for CSG to deploy any non-fossil-fuel generation sources to meet its demand growth and displace its coal generation. Hong Kong will not be able to exert any control or meaningful influence on either the mainland government's or CSG's diversification or energy strategy. Hence option 1 cannot be seen as a short-cut to diversification or

⁴⁰ Consultation Paper, p30

greener energy.

76. HK Electric believes that there are local opportunities, which are fully within Hong Kong's control, for diversification without having to rely on the mainland. Hong Kong should act on its own commitment to combat climate change, rather than outsourcing its responsibility to our neighbours in the region.

Local Diversification Opportunities – Diversified Gas Sources

77. Gradual globalization of the natural gas market will enhance fuel diversity by bringing in new sources of gas worldwide, both conventional and unconventional. Instead of focusing on fuel diversification and importing electricity from neighboring regions, Hong Kong can diversify its gas supply sources by bringing in its own floating LNG terminal to enhance energy security by supplementing the pipeline gas sources. Singapore applied a similar concept of gas source diversification rather successfully to back up its substantial gas generation from ~19% in 2000 to ~90% in 2013.

Local Diversification Opportunities - Renewable Energy

- 78. The Consultation Paper, disappointingly, is virtually silent on RE as a source of fuel for Hong Kong. HK Electric believes that the Government should consider its RE strategy ahead to enhance generation diversification and to demonstrate Hong Kong's all-out commitment to green energy.
- 79. Both power companies have done their parts by installing, whenever feasible, RE systems and grid-connecting their customers' RE installations. To promote green energy, HK Electric introduced in 2006 the 0.8MW wind turbine, Lamma Winds, which was the first of its kind in commercial-scale in Hong Kong. Encouraged by the satisfactory generating output and positive response, we further developed the 1MW commercial-scale solar power system in two phases (550kW in 2010 and 450kW in 2013). Since their completion, these two systems have been contributing in total over two million units of green energy per year to HK Electric's generation portfolio.
- 80. Presently we are planning to develop an offshore wind farm off Southwest Lamma. The analysis of the wind resource data measured at the proposed site since March 2012 has indicated that the proposed site can be feasibly developed into an offshore wind farm. CLP is also undertaking its wind farm project. Based on the feasibility studies and in-situ wind measurements conducted by the two power companies, it is

expected that the developments of the two proposed off-shore wind farms within Hong Kong waters are economically and operationally viable. The estimated total output could be well over 1.5% of Hong Kong's annual total electricity demand, and compares well with the target of Guangdong for this decade. Together with the planned waste-to-energy facilities initiated by the Government, over 3% electricity may be generated by large scale RE in the early 2020s.

Local Diversification Opportunities –Cleaner Coal Technologies

 Apart from diversifying natural gas supply sources, Hong Kong can also explore other technologies including coal gasification and integrated gasification combined cycle (IGCC) system to supplement conventional natural gas generation.

(E) FLEXIBILITY IN SCALING UP FUTURE SUPPLIES

82. The Consultation Paper identifies the need to satisfy the future electricity demand in light of the replacement of aging generating units as a key reason to review and plan ahead the fuel mix in Hong Kong. The Government states:

"some of the power generating units will start to be retired in the coming years. This presents an opportunity to explore how they should be replaced, and calls for a reassessment of the overall fuel mix and early planning of necessary new generation and/or transmission infrastructure; we have to satisfy rising demand for electricity notwithstanding the small growth projected.⁴¹"

- 83. An integrated resource planning approach is warranted to evaluate not only the supply-side but also the demand-side resources. Given the inherent uncertainty associated with demand forecast, the future fuel mix should be one that is built in with sufficient flexibility to adapt easily to changes in demand.
- 84. HK Electric considers that option 2 is more suitable as it allows flexibility in scaling up (or, if necessary, down) future supplies. Option 1 is a very rigid choice in adapting to changes in future demand, due to the huge infrastructure investment in the transmission link at a specific capacity for importing electricity through the CSG to Hong Kong and the long lead time required for the construction of the infrastructure,

⁴¹ Consultation Paper, p11

which can easily take more than 10 years. There is little flexibility to scale up or down future supplies. On the other hand, option 2, which relies on local gas generation to curb emissions, can easily adapt to changes in future demand since the new gas fired units, with much shorter lead time of four to five years, can be installed at the power stations on the previously allocated land on a gradual unit-by-unit basis in response to the dynamic demand condition.

(F) SOCIAL CONSIDERATIONS

- 85. HK Electric considers that option 1 will give rise to unnecessary and undesirable social issues which can wholly be avoided under option 2.
- 86. The Hong Kong power industry has excellent track records and has achieved supply reliability which is among the highest in the world. If Hong Kong is to go for option 1, it will be reducing the scale of local generation. Jobs and businesses will be sent to Guangdong, at the expense of local employment and the economy. Hong Kong's young engineering professionals have expressed concern that their job prospects and career development will be adversely affected by option 1. The concern is legitimate as there will be much reduced career opportunities in power plant design, investment, construction, operations and maintenance in Hong Kong. Option 1 will, in the end, irreversibly hasten the disappearance of the local expertise of Hong Kong power industry, and lead to increasing reliance on generation from CSG.
- 87. Under option 2, engineering and technical skills specializing in the safe operation of generation units will be retained in Hong Kong to ensure high supply reliability that is expected of Hong Kong as Asia's world city. It also helps foster a local industry of research and professional training.

(G) IMPLICATIONS FOR THE POST-2018 ELECTRICITY MARKET

88. The Consultation Paper states :

"... the import option will involve the construction of new cross-boundary transmission network. This may enhance interconnection between the two local power grids, and hence provide more room to introduce competition at the

generation level.⁴²"

HK Electric believes that this is misconceived for the following reasons.

Local Competition

- 89. Any potential for competition will be substantially limited by the long-term contracts for grid power purchase (~30%) in addition to those for nuclear power purchase (~20%) and gas purchase (~40%). With 90% of the market share locked in by these long-term contracts, there can hardly be any meaningful competition. The increasing reliance on grid import to reduce local emissions will only force the Hong Kong electricity market to end up with a single bulk supply from CSG at a price it dictates. By then, Hong Kong will not have sufficient local capacity to walk out of the arrangement.
- 90. In addition, the large scale cross-boundary transmission infrastructure investment associated with option 1 will, in view of stranded cost and other considerations, more seriously impede the ability to change the future electricity market.

Interdependency and System Disturbances

91. The two power companies have been interconnected since 1981 to provide emergency support to each other. However, as power grids get increasingly connected, their mutual influence toward one another will grow accordingly. The planned or unplanned outages of one side will unavoidably impact on the other side. Based on overseas experiences, there are primarily several key drivers for increasing interconnection but all of them have little relevance to Hong Kong. For some jurisdictions, their complementary supply/demand characteristics enable cost saving through interconnection. However, Hong Kong and Guangdong share similar load profiles and experience peak load at roughly the same time, hence there is no time of day or seasonal advantage to be gained from importing via interconnection. For other jurisdictions, grid import is driven by competitive prices of imported electricity. However, given the long-distance transmission required for grid import from CSG, the imported electricity prices will unlikely be competitive especially from a longer term perspective. Moreover, since CSG is essentially an overhead line system where its inherent reliability is lower than that of Hong Kong, interconnection with CSG will no

⁴² Consultation Paper, p37

doubt bring down Hong Kong's reliability level. Though interconnection can be an effective measure for some jurisdictions to improve their supply reliability, this does not apply to Hong Kong as it already has one of the most reliable electricity systems in the world.

92. Hong Kong is a densely populated vertical city, and supply reliability is definitely not something to be taken for granted, nor be left to chance. While grid interconnections are common in many jurisdictions, their drivers or justifications are absent in Hong Kong. For those jurisdictions which import grid electricity, they have often faced problems associated with power quality created by the grid interconnection.

VI. THE MACAO EXPERIENCE

- 93. The Consultation Paper draws heavily on the electricity import in Macao as a model story for Hong Kong to follow. What can we observe from Macao's grid connection?
- 94. Macao faces a very different demand and supply situation from Hong Kong's. The amount of electricity imported by Macao is much smaller than the 30% of Hong Kong's demand proposed to be imported⁴³. The grid interconnection of Macao has been essential for its rapid development of tourism and leisure industries over recent years in order to overcome its scarce land resource available and long lead time to build up the required electricity generation capacities.
- 95. Hong Kong has outperformed Macao in terms of reliability, environmental performance, diversification and affordability. HK Electric considers that the Macao's experience is a valuable one for Hong Kong to learn, and the problems faced by Macao should be avoided. The Macao model presents a convincing case against option 1.

<u>Reliability</u>

- 96. As Macao and Zhuhai are in close proximity, the transmission link for grid import is much shorter as compared to what may be required for Hong Kong, and involves lower investment cost and supply reliability risks. The much shorter link length (~6 km)⁴⁴ also allows daily patrol along the link to enhance reliability. It should also be noted that Macao built its first cross-boundary link with Zhuhai back in 1984 and expanded the interconnection over the past 30 years to reach the present dual corridor (north and west) 9 circuit configuration with a total installed capacity over three times the maximum demand of Macao.
- 97. Even so, Macao is still unable to stay immune from the system disturbances arising from the grid. To cater for the higher risk exposure, the commercial and entertainment complexes in Macao are equipped with their own backup generators and UPS in much larger scales than those required to meet the mandatory fire and safety needs. Such contingency provisions, considering the costs involved, will not be acceptable and practical for most customers in Hong Kong.

⁴³ The electricity imported by Macao is roughly a quarter of the proposed grid electricity to be imported under option 1

⁴⁴ On the basis of flat land accessible to road traffic

- 98. To relieve Companhia de Electricidade de Macau (CEM), the public utility supplying electricity in Macao, from bearing the responsibility of supply reliability issues outside its jurisdiction, the local regulatory framework only requires CEM to report incidents arising under its sole responsibility. According to CEM, their reported supply reliability of 99.9996% in 2013 is only based on outages under its responsibility and does not reflect any supply outages or limitations of the mainland power grid⁴⁵. The actual reliability of the whole system is not disclosed and therefore unknown. This is in stark contrast to Hong Kong in which the supply reliability covers the whole supply chain from generation, transmission to distribution to customers.
- 99. Recently after a series of power interruptions in Macao, there have been public concerns that the local generation capacity is insufficient to meet daily demand and that local natural gas electricity generation should be the best option for Macao in the longer term⁴⁶.

Environmental Performance and Diversification

100. Macao's carbon intensity (918g/kWh)⁴⁷ is significantly higher than that of Hong Kong (577g/kWh)⁴⁸ (Figure 14).



Figure 14: Comparison of GHG Emission Factors of Macao & Hong Kong in 2012

⁴⁵ <u>CEM's press release of 31 March 2014 on Annual General Meeting</u>

⁴⁶ 「<u>氹仔昨停電影響二千戶</u>」(澳門日報(Macao Daily), 15 March 2014)

⁴⁷ Based on <u>CEM Sustainability Report 2012</u>, the CO₂ emission factor from the existing fuel mix in Macao, i.e. 8.66% local generation, 88.75% grid purchase from CSG and 2.59% from incinerator is 918g per kWh of electricity generated/purchased

⁴⁸ Based on CLP Sustainability Report 2012 and HK Electric Sustainability Report 2012, the CO₂ emission factor from the fuel mix in Hong Kong in 2012 (i.e. 23% nuclear, 22% gas and 55% coal) is 577g per kWh of electricity generated/purchased

- 101. This high CO_2 emission factor in Macao as compared with that in Hong Kong is attributed to the high CO_2 emission associated with the electricity imported from CSG. Although the imported electricity is generated in China and the CO_2 emission does not come out from any local power station, CEM has taken the indirect emission into their account. In 2012, Macao imported 3,855GWh⁴⁹ with an indirect CO_2 emission of 3,602,402KT⁵⁰ and a CO_2 emission factor 934g per kWh. This is basically CO_2 emission from CSG's coal generation for CEM's imported electricity⁵¹.
- 102. With 90% of its electricity being supplied by coal generation in Guangdong, there is in fact no fuel mix diversification in Macao despite its CSG grid connection.
- 103. If Hong Kong were to import, the emissions might be worse than Macao's. Unlike Macao which is in close proximity to Zhuhai, cross-boundary transmission link of much longer distance is required for option 1 to deliver the electricity to Hong Kong resulting in significant network losses (~6-7%). Higher emissions will therefore be incurred as a result of additional coal generation required for making up the losses.

Affordability

104. The import of electricity from CSG to Macao illustrates how vulnerable a captive buyer could be once it becomes reliant on import. In 2013, Macao's domestic electricity tariff was HK\$ 1.31 per unit (electricity purchase price of MOP 0.84 per unit + other service charges)⁵², which is 30% higher than HK Electric's HK\$ 1.00⁵³. From 2008 to 2013, Macao's purchased power price has increased by ~27%⁵⁴; whereas HK Electric's overall tariff only increased by ~6% over the same period.

⁴⁹ <u>CEM Sustainability Report 2012</u>, p 86

⁵⁰ CEM Sustainability Report 2012, p 54

⁵¹ According to International Energy Agency's " CO_2 Emissions from Fuel Combustion (2013 edition)" (p 41), the implied carbon emission factors from electricity generation for each of sub-bituminous coal, other bituminous coal and natural are 925g, 860g and 400g CO_2 / kWh respectively

⁵² Tariff is based on "<u>Tariff Group A1 – General Tariff</u>" posted on CEM website , with exchange rates as at 16 April 2014. Macao's electricity purchase price refers to the data for 4th quarter of 2013

⁵³ Consultation Paper, p 6, Figure 5; comparison is based on average monthly consumption of 275kWh (annual consumption at 3,300kWh)

⁵⁴ 澳門特別行政區能源業發展辦公室 2008年第2 季及2013 年第4 季能源及服務綜合資料 (Energy and services information for Quarter 2 of 2008 and Quarter 4 of 2013, the Office for the Development of the Energy Sector, Macao SAR) (<u>http://www.gdse.gov.mo/gdse_big/newsDetails.asp?newsIndex=414</u>)

VII. CONCLUSION

- 105. HK Electric's submission clearly demonstrates that option 2 prevails over option 1 when assessed against the Government's four energy policy objectives and other considerations identified in the Consultation Paper.
- 106. As one of the most affordable cities in the GPRD region and with world class electricity supply service and associated infrastructure already in place, Hong Kong should assume its own responsibility for improving the future fuel mix. This will assure not only the continuity of our electricity supply reliability at competitive tariff and improving environmental performance, but also the migration of the entire GPRD region to a cleaner environment and as a showcase for effective electricity regulatory framework.
- 107. There is no case for a choice of option 1. We firmly believe option 1 will endanger Hong Kong's supply of safe, reliable and reasonably priced electricity and will increase (rather than decrease) GHG and other emissions, with tariff impact being much more significant than that under option 2. The huge upfront investment in constructing the cross-boundary electricity import infrastructure will render Hong Kong captive to grid import with little bargaining power. The development of the Hong Kong electricity market will be left with no choice but to rely continuously on CSG for electricity supply.
- 108. On the contrary, option 2 is a flexible and workable option that allows for gradual changes and is proven to be able to maintain Hong Kong's world class electricity supply record. It is expected to bring about visible and measurable environmental improvements to reduce regional GHG and other emissions and the tariff impact will be far less substantial compared with that under option 1. As it only takes four to five years to build a gas-fired unit, option 2 offers far greater flexibility to replace coal generation by gas generation progressively in phases depending on the actual demand growth. The required land and infrastructure for increasing the local gas generation are already in place to assure timely completion of the new generating plant construction. In addition, under the Scheme of Control regulatory regime, local tariffs are subject to stringent government and public scrutiny and price setting mechanism is open and transparent.
- 109. HK Electric's recommendation is that the Government should adopt option 2 as the blueprint for Hong Kong's future fuel mix for electricity generation.

FRX ND. 1

Jun. 18 2014 14:84 Pi

618 13 01 002

618B00002

中國高等院校香港校友會工程師聯合會 對《香港的未來發電燃料組合公眾諮詢》的圖燈回應

環保局電力檢討科 台豎

本會就上統公認請詢, 鏢過擦射並作回應,由於泰格第二部分燃料組合的方 案1及2的構成背景沒有深入瞭解,本會對提供的兩個方案均不支持,本會的意 見如下:

- 1、方案1及2在操作上基本是安全的,但對天然氣需有更高的安全要求。現時 中華電力的天然氣是通過單一海底管線,從南中鐵海的氣井輸往香港西部的 電廠,港燈的天然氣則是利用單一的管線,從廣東大廳灣天然氣碼頭經東部 海底,把進口的天然氣輸往南丫島發電廠。兩電的天然氣供應都是獨立而不 互通的,天然氣供應的安全應再作檢討。
- 2、供電的可靠性是社會討論的重點,尤其是從電網購電,政府應爭取南方電網 在投入和行政上對供電的可靠性作承諾。現時中華電力已擁有跨境輸電網絡 並有豐富操作經驗,未來更應從珠海經南面向香港輸電,形成南北連網,加 強供電的可靠性。

随著南海局勢升温,傳統天然氣供應的安全及可靠性應作重估。

- 3、市民最關心就是電價,政府已初步披露兩方案的電價相約,未來需詳盡解釋, 讓市民接受比目前較高的電價是合理的。政府應參與購電談判,簽訂長期供 電合同,並對電網建設投資,以穩定電價。
- 4、 在環保表現方面,方案1及2均保存10%及20%的煤電,煤是高污染源,資 不宜設在人口稠密的香港,建議考慮從本土發電燃料中剔除,或遷到珠三角 以外。
- 5、方案1及2在發電環節對人才需求略有差異,針對發電的專門性,應考慮現 有發電人力資源及人才供應的配合。

中國高等院校香港校友會工程師聯合會 電話:: 電郵::

83%

P.81

618 B00023

618B00023



燃料組合

		輸	l		内容	
燃料組合		核能 (大亞灣核電站)	從電網購電	天然氣	(及可再生能源)	
現時	(2012)	23%	-	22%	55%**	
方案4*	通過從內地電 線時愛回給 1	20%	30%	40.67	4001	
	更多電力	總共;	50%	40%	10%	
方案2*	利用 更多天 然 氯作本地聲電	20%		60%	20%	

*以上的燃料比例用以提供一個基礎作規劃確力供應所需的基準。不同燃料的實際分配應该實際情況確定。

**包括少量发油。

61830023

第三部分

10

具體諮詢問題

問1: 就安全、可靠性、合理價格、環保表現及其他相關的考慮而言,你對兩個燃料組合方案 有何意見?(請就每個方案説明你的看法)

	方案	支持	不支持	不支持方案的原因 (可選擇多過一項)	
	1			 □ 安全 □ 可靠性 □ 合理價格 □ 環保表現 □ 其他(請註明): 	
	2			 □ 安全 □ 可靠性 □ 合理價格 □ 環保表現 □ 其他(請註明): 	
問2: 作	尔認為在兩個	燃料組合方 ¹	案中,哪一個輔	咬理想?為什麼?(請只選擇 ─個)	
ブ					1
厦	₹ 見:(可選擇)	多過一項)			a second and
3	☆全 [⊻ 可靠性 [⊻				
名	合理價格 ⊵ 瞏保表現 []]			
J	も しして しんしょう しんしょ しんしょ	」請註明	·		
第四音	『 分	汉时间	一町1)夏雨	活動陸南電公司の330%、用地重勢	议大中国
其他	意見或建	議的広	的主动库	第10号IN系导了、风耳剧的将宽格	瓜荫荫,
北京	毛、菌烯	及信金	粤, 长了表。	大发在婚、全氯不足、图的設施及	脱情
É.	破爛不言	塵、臭氣	蓝天众晚港	理人才雙素高彻、近年港、鉄車廂等	已施中
國對	起恶力、港	狱宫外事	故小元病日	多反影管理览素嚴重影響正常	運作!
T	彭政府有	刷专门的	不聽比意	、凤水水電都倚顧風內、香港中展到	是階段到

	618B00056		18 JUN 2014	610 00	
					Anne
	Resp	onse Form			124
Public Con	sultation on Future Fuel N	Aix for Electr	ricity General	tion for Hon	ig Kong
Diance cord	this response form to us on or bet	ore 18 June 20	14 by one of thes	se means:	-
mail: Env	vironment Bureau, Electricity Revi	ews Division, 18	S/F, East Wing,		
Cen	tral Government Offices, 2 Tim M	ei Avenue, Tam	ar, Hong Kong		
e-mail: fue	L_mix@enb.gov.hk				
fax: 214	17 5834	-			-
-	geodesine, S				
Part 1 (See N	oles)				
This is a	Corporate response (repres	enting the view	s of a group or an	n organisation)	or
	8	onling the view	s of an individual	1	
	Individual response (repres	enning me nem			
	Langdon & Seah Hong	Kong Limited	(Attn.: Mr. Pet	er Ho)	
	by Langdon & Seah Hong	Kong Limited (name of pers	(Attn.: Mr. Pet	er Ho)	
	by Langdon & Seah Hong	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation	er Ho)	
and the second	by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation (e-m	er Ho) n ail)	
B2.4124	by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation (e-m	er Ho) n ail)	
Part 2	by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation (e-m	ail)	=13
Part 2	by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation (e-m	all)	27
Part 2 Fuel Mix	D Individual response (repres by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers	(Attn.: Mr. Pet on or organisation (e-m	er Ho) n	22.
Part 2 Fuel Mix	D Individual response (repres	Kong Limited (name of pers and	(Attn.: Mr. Pet on or organisation (e-m	er Ho) ni	
Part 2 Fuel Mix	D Individual response (repres by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers and IMP NUCLEAR (DRNPS)	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE	er Ho) ni all) NATURAL GAS	COAL (& RE
Part 2 Fuel Mix	D Individual response (repres by Langdon & Seah Hong at (telephone)	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23%	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE	er Ho) n ail) NATURAL GAS	COAL (& RE
Part 2 Fuel Mix	Dindividual response (repres by Langdon & Seah Hong at (telephone) Options FUEL MIX Existing (2012) Importing more electricity	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23% 20%	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE 30%	er Ho) n ail) NATURAL GAS 22%	COAL (8 RE 55%
Part 2 Fuel Mix	Dindividual response (repres by Langdon & Seah Hong at (telephone) Options FUEL MIX Existing (2012) Importing more electricity through purchase from the Mainland power grid	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23% 20% Tota	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE 30%	er Ho) n all) NATURAL GAS 22% 40%	COAL (8 RE 55%
Part 2 Fuel Mix	Langdon & Seah Hong by Langdon & Seah Hong at (telephone) Options FUEL MIX Existing (2012) Importing more electricity through purchase from the Mainland power grid Using more natural gas	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23% 20% Tota	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE 30%	er Ho) n all) NATURAL GAS 22% 40%	COAL (& RE 55%
Part 2 Fuel Mix	Langdon & Seah Hong by Langdon & Seah Hong at (telephone) Options FUEL MIX Existing (2012) Importing more electricity through purchase from the Mainland power grid Using more natural gas for local generation	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23% 20% Tota 20%	(Attn.: Mr. Pet on or organisation (e-m ORT GRID PURCHASE 30%	er Ho) n ail) NATURAL GAS 22% 40% 60%	COAL (8 RE 55% 10%
Part 2 Fuel Mix	Langdon & Seah Hong by Langdon & Seah Hong at	Kong Limited (name of pers and IMP NUCLEAR (DBNRS) 23% 20% Tota 20%	(Attn.: Mr. Pet on or organisation (e-m ORT CRID PURCHASE 30%	er Ho) n all) NATURAL GAS 22% 40% 60%	COAL (& RE 55% 10%

NO. 422)

618800056

Part 3

Q1:

Specific Questions for Consultation

How do you view each of the two fuel mix options with regard to safety, reliability, cost, environmental performance and other relevant considerations? (Please indicate your view on EACH of the two options.)

	Option	Support	Not Support	Reason for NOT supporting (You can tick more than one box)
	1			Safety Reliability Affordability Environmental performance Others (please specify):
	2		ndenti prob s salte senset s sel la s	Safety Reliability Affordability Environmental performance Others (please specify):
Q2:	Which of the two Option 1 Option 2	o fuel mix op	tions do you pre	fer? Why? (Please tick ONLY ONE box)
	Reasons: (You o Safety Reliability	an tick more	than one box bo	elow)
	Affordability		7	
	Environmental Others	Performance	e 🗹 🛛 Please	Specify: Natural gas price likely runs a downward leans after research in and
Devid				Contraction of the second

Other Comments and Suggestions

(1) The environmental performance of Option 1 is considered taking into account the impact to the mainland China as a whole due to the increase in electricity supply. The quality of the air in mainland China may also affect Hong Kong. (2) There is no guarantee on the affordability of Option 1 especially in the long run.

618B00057

FAX PAGE BY PAGE #1/2

18 JUN 2014

Ann 618800057

P.01

I Please	send this response form to us on or before	by one of these means:	1
t mail:	Environment Bureau, Electricity Reviews Divisio	n. 15/F. East Wind.	*
1	Central Government Offices, 2 Tim Mei Avenue.	Tamar. Hong Kong	1
i e-mail:	ruei mix@enb.oov.hk		
Hax:	2147 5834	A CONTRACT OF A	

28

ive coroorate response (representing the views of a group or an organisation) or individual response (representing the views of an individual

(name of person of organisati"

sorrv-too many colo calls & lunk emails from others

TE. CHECTUTE DEPTION 20 BUN LOCALLY

(terenone)

		ţ.	ga7	4.55 Min Pali	NATURAL	COAL	
ï	FUEL MIX	1	NUCLEAR (DBNPS)	GRID PURCHASE	GAS	(& RE)	+
	Existing (2012)	ţ	23%	1	22% :	55%	1

18-JUN-2014 19:02

r.2/2 618 B 000 57

01

-1-

How do you view each of the two fuel mix options with regard to safety, reliability, cost, environperformance and other relevant considerations? (Please indicate your view on EACH of the two potions.)

Gption	Support	Not Support	(You can tick more than one box)
1			Image: Stream of the stream
2			III SELLO WHY TAKE MCRE Reliability Affordability Environmental performance Others (please specify):
Mich of the two Optici, , Jotion 2	fue! mix octi	ons do vou prefe	ar? Why? (Please lick ONLY ONE box)
easons: (You ca	In tick more t	nan one pox pe	
lafetv leliability ffordability	5.8 116.8		in a Salari Na Salari Na Salari
there	erformance		
		Please :	SDBCify: HX septrimose, quick repair (observation from years)

As a financial centre. HK cannot afford seconds of Black Out (unlike Macau, a gambling in resort). Climate change means more unpredictable phenomenon, e.g. hailstone. Icestorm in a N America. Pearl Delta Region, Qian Hai, Heng Qin have a huge electric demand in the coming years when the transport infrastructure. Free Trade Zones are completed. Look at "Land Reserve" in annual reports of property developers, e.g. Aoyuan, Agile, Country Garden.

18-JUN-2014 19:05

618B00059

286

618800059

78-104-5974 18:55



X. et et al.



618BODO59

18-20M-5014 18:52

第三部分

21

e

50'd

具體諮詢問題

問1:就安全、可靠性、合理價格、環保表現及其他相關的考慮而言,你對兩個燃料組合方案 有何意見? (請就 44 廣方案説明你的著法)



268