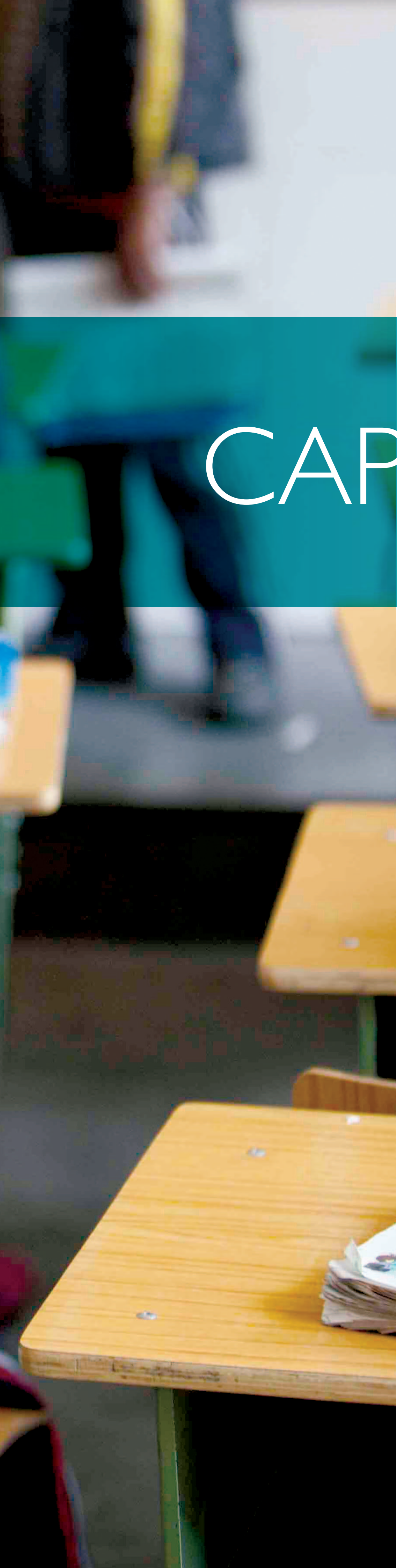


CAPITALS

What are the "capitals" that sustain our business?

We have selected some resources and relationships – collectively known as "capitals" – that are critical to CLP and explain how the prudent management of these can contribute to the sustainability of our business

FINANCIAL CAPITAL

Our funding resources and capability

After several years of extraordinarily low interest rates, from the second half of 2013, economic data from most countries finally pointed to an improving global (notably the United States) recovery picture.

Earlier in the year, investors were briskly searching for yields at a time of unprecedentedly low interest rates. Such "risk-on" behaviours were seriously challenged when, in May 2013, the Federal Open Market Committee minutes divulged that a number of the Federal Reserve Governors had expressed a willingness to begin scaling back monthly asset purchases as early as June 2013 to forestall inflationary pressure. The market implications of this paradigm shift were massive – market participants scuttled to adjust their portfolios, causing 10-year US treasury yields to surge from 1.7% in April to over 3% in September and emerging market currencies (such as the Indian rupee and the Indonesian rupiah) to plummet up to 25% against the US dollar at one point.

Such fear of "Fed Tapering" as well as credit tightening in the Chinese mainland resulted in a spike in interbank rates and continued to send global financial markets tumbling. Equity, commodity and foreign currency markets faced tremendous selling pressures (with the exception of the US dollar). Activities in primary bond markets came to a halt again, the second time after an effective shutdown in the second half of 2011. Financial markets only settled down after the Federal Reserve clarified it would "maintain a highly accommodative monetary policy as long as needed" and that "any decision on tapering would depend upon improvement in the jobs data."

The earlier-than-expected start to quantitative easing tapering prior to Christmas in 2013 and the Federal Reserve's forward guidance to keep "the level of accommodation more or less the same level" still awaits a full response from markets. That said, the precautionary measures that CLP has taken in 2013 (as detailed below) should have further safeguarded the Group's financial and business position.

Applying Discipline and Dynamism in Meeting Business Needs

Over the past couple of years, the "Financial Capital" sections of our Annual Report portrayed CLP's funding model and how it could enhance our financing strength and flexibility. Our ability to procure diversified, cost-effective, multiple-tenured external financing on a timely basis without undue market risks (liquidity, (re)financing, interest rate) is critical if we want to perform well in the capital intensive power industry. This year we intend to use a few illustrations to demonstrate how we apply discipline and dynamism in our financing risk management activities, with the objective of achieving longer-term shareholder value.

Irrespective of market conditions, we never depart from our prudent financing management philosophy. Also, we avoid any temptation to apply personal views on market movements as we believe quality financial policies and a high level of self-discipline are most important. That said, we closely monitor the markets, cultivate business relationships with new lenders while maintaining rapport with existing ones, review our business requirements and move swiftly to execution so that we may deliver greater value to shareholders.

CLP faced a number of challenges in 2013. Our financing and treasury activities were implemented by way of considered strategy to manage liquidity and financial risks, enabling our group companies to sustain and grow our business. Activities included:

- completing a HK$10 billion bridge financing by CLP Holdings at competitive terms and finalising the associated loan documents for acquiring an additional 30% interest in CAPCO and remaining 51% interest in PSDC when the respective parties accelerated the final round of discussions in October 2013. While CLP Holdings and

CLP Power Hong Kong had approximately HK$24 billion in undrawn credit facilities and internal resources which were more than enough to pay for the acquisitions, we decided to include a fully committed bridge loan upfront to allow CLP ample time to secure an optimal permanent financing structure and maintain good liquidity. In view of the tremendous interests indicated by other banks to join the bridge financing, we completed syndication of HK$5 billion with 12 multinational and regional banks in January 2014.

- tapping into the onshore Japanese yen bank market to secure a more cost-effective funding of CLP Power Hong Kong's SoC business through completion of a JPY12 billion (HK$934 million) loan syndication, simultaneously broadening its lenders' base. Though the highly successful placement of US$600 million dual tranche Regulation S public bonds in October 2012 had left CLP Power Hong Kong with only modest funding requirements in 2013, it remained self-vigilant and continued to search for the most cost-effective funding to support the SoC business. This transaction took advantage of the good liquidity in the Japanese banking market, particularly after the rollout of "Abenomics" in December 2012 where Japanese-based financial institutions were more eager to lend offshore. With assistance of two arranging banks, this JPY12 billion, 3-year cross-border loan was successfully syndicated to 13 regional and city banks in Japan with a 1.5 times oversubscription. CLP Power Hong Kong swapped the full amount of the Japanese yen proceeds into Hong Kong dollars at a cost lower than conventional Hong Kong dollar bank loans for the same tenor. According to the lead arranging banks, this is the first Japanese yen cross-border bank loan ever arranged in Japan for a Hong Kong borrower on a syndication basis.
- converting HK$4.1 billion floating rate debts for CLP Power Hong Kong into fixed rates mostly in early 2013 to further enhance the certainty of earnings and cashflow as part of our risk management strategy when the market was still debating the future course of interest rates. CLP never pretends it can predict financial market or rates movement (nor will we). Instead of trying to speculate when Fed Tapering will come and by how much, we prefer to exercise great discipline in identifying the respective risks, evaluating options and implementing risk

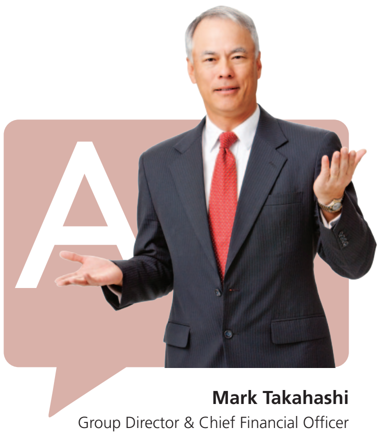
Ms Susan Yuen
CEO, Hong Kong
Australia and New Zealand Banking Group Limited

CLP's strategy is to diversify its business beyond reliance on a single sector in Hong Kong and to capitalise on the growing opportunities in overseas markets. However, the upshot of this approach may result in pressure on CLP's credit rating. How does CLP strive to maintain a balance between its credit rating and optimising the overall cost of finance?

As the Hong Kong market is mature, overseas expansion provides an opportunity for us to grow, diversify risk and create shareholder value. The expansion of our business should not be detrimental to our financial well-being. In reviewing investment proposals, we carefully consider the impact on our financial ratios. We also maintain a strong dialogue with credit rating agencies to explain the rationale and implications of major acquisitions, as strong investment grade credit ratings are important to CLP. This is particularly so with respect to CLP Power Hong Kong as a relatively frequent issuer in the debt capital markets. It is also important for EnergyAustralia given the high level of hedging activities associated with an electricity business in a competitive market.

That said, we also recognise that equity is a more expensive source of capital than debt. We have therefore been careful and deliberate when considering new equity fund raising at the CLP Holdings level. The HK$7.56 billion share placement in December 2012 was the first time we raised equity capital in more than a decade, and provided some additional buffer for growth investments. It should also be noted that our financial strategy includes raising equity capital at the business unit or project level, either through listings or targeted sell-downs. This provides an opportunity to realise value as well as recycle capital for future growth.

In summary, while we are careful in using incremental debt, we recognise that we must balance this with our desire to minimise the cost of capital. Importantly, independent of our specific ratings in our various entities, we believe that we will continue to have strong access to external debt funding through prudent investment / financial management, good relationship with lenders / investors plus sound planning and execution.



Mark Takahashi
Group Director & Chief Financial Officer

management measures in accordance with our prudent but well-proven financial policies so that we can fence off unwarranted financial risks and maintain good financial health to operate and grow. As of the end 2013, CLP Group's fixed rate debt to total debt was approximately 67% (2012: 57%), a level which would provide us with better protection in view of rising interest rates and event risks.

- completing an early-refinance of EnergyAustralia's aggregate A$2.1 billion bank facilities maturing in stages commencing from 2014 to ensure ample liquidity and lock in lower levels of interest margins. Notwithstanding that EnergyAustralia's credit rating was revised downward to BBB- from BBB with negative outlook, it was able to leverage on its good relationship with Australian and regional banks, a very liquid Australian dollar bank loan market, further tightening of interest margins and the "CLP halo" to launch an expeditious refinancing programme which was finalised in January 2014. The refinancing has enabled EnergyAustralia to extend the maturities of the entire A$2.1 billion facilities by an average of 1.8 years at all-in interest margins lower than that of the expiring bank facilities.

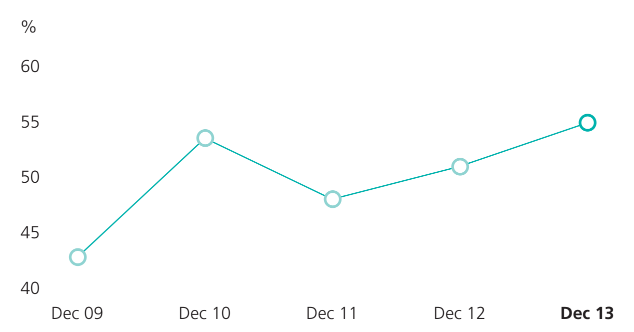
A Diversified, Sustainable, Cost-effective Funding Approach

We endeavour to build and maintain long-term relationships with financial market participants, including bond investors, bank lenders, and risk management counterparties as opposed to "cherry picking" the lowest price bidder to reduce costs. As at 31 December 2013, the Group had maintained business relationships with 67 financial institutions (2012: 56). This number has almost doubled over the last decade from about 36 financial institutions in 2003, demonstrating our continuous efforts in developing and broadening our business relationship base. The majority of the banks we had relationships with a decade ago are still working in partnership with us, demonstrating the sustainability of our relationship. The increase in number of financial market partners in 2013 signals the new relationships we set up with Japanese-based financial institutions through the Japanese yen cross-border syndication loan arranged by CLP Power Hong Kong.

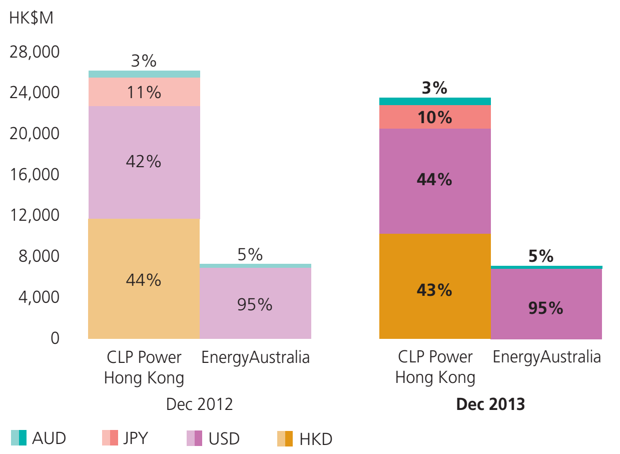
Apart from bank loans with multinational, regional and local banks, the Medium Term Note (MTN) Programmes adopted by CLP Power Hong Kong and EnergyAustralia provide flexibility in allowing these entities to reach out to investors in other parts of the world with a short lead time for aggregated amounts of up to US$4.5 billion (increased from US$3.5 billion) and A$2 billion respectively. These programmes also help diversify funding sources from the banking sector, deliver cost-effective fixed rate of borrowings and lengthen debt maturity to match with the long payback period of the electricity business. As at 31 December 2013, CLP Power Hong Kong has an outstanding 39 tranches of bonds (denominated in US dollar, HK dollar, Japanese yen and Australian dollar) with a nominal value of about HK$25 billion issued under its MTN Programme while EnergyAustralia has one outstanding tranche of Australian dollar bond (A$50 million) issued under its MTN Programme and 10 tranches of US dollar bonds (US$895 million) issued through the US private placement market. We have further extended our debt funding from bank lending to bonds (public and private) since the global financial crisis to capture the merits of low interest rates and lock in attractive, long-tenured, fixed-rate funding; and reduce the impact of the higher costs of bank lending attributable to the implementation of Basel III. As at 31 December 2013, about 47% and 48% of debt funding at CLP Power Hong Kong and EnergyAustralia came from bond investors based outside Hong Kong and Australia respectively.

The financial market upheavals which commenced in the United States in 2008 and subsequently proliferated to Europe reminds us of the importance of maintaining good but diversified relationships with financial market participants in different regions. This will not only protect CLP from being adversely affected by event risks in different parts of the world but also allows us to better manage geo-political exposures which may arise from distinctive fiscal and monetary policies implemented by various governments and central banks.

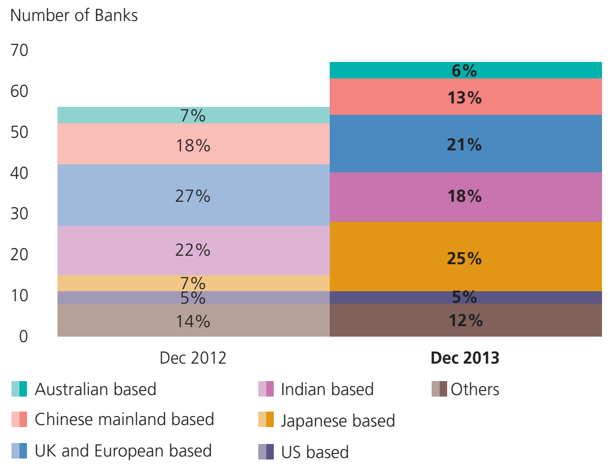
Ratio of Bond Funding to Total Debt



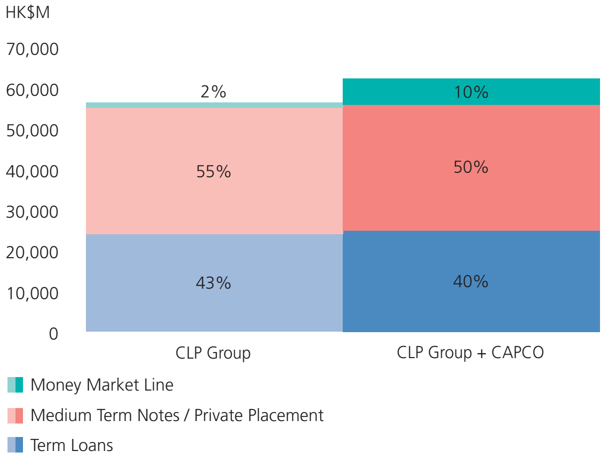
Currency of Bond Funding



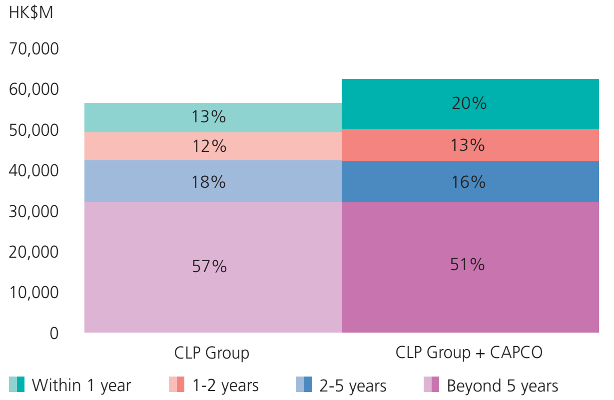
CLP Banking Relationship – Balanced Mix of Lending Financial Institutions



Loan Balance – Type



Loan Balance – Maturity



Note: Loan balance between one to two years includes loan drawdown with current tenor less than one year under revolving facility with maturity falling beyond one year.

Debt Profile as at 31 December 2013

	CLP Holdings HK$M	CLP Power Hong Kong HK$M	Other Subsidiaries[1] HK$M	CLP Group HK$M	CLP Group + CAPCO HK$M
Available Facility [2]	16,600	33,672	38,997	89,269	95,534
Loan Balance	1,416	28,283	26,352	56,051	61,928
Undrawn Facility	15,184	5,389	12,645	33,218	33,606

Notes:
1 Mainly relates to EnergyAustralia and subsidiaries in India.
2 For the MTN Programmes, only the amounts of the bonds issued as at 31 December 2013 were included in the total amount of Available Facility. The Available Facility in EnergyAustralia excludes a facility set aside for guarantees.

In 2013, interest cover (which equals profit before income tax and interest divided by the sum of interest charges and capitalised interest) was 3 times (2012: 4 times). The financial obligations of the Group, CAPCO and PSDC, and the Group's share of the financial obligations of joint ventures and associates as at 31 December 2013 are shown on page 35.

In 2013, guided by the effective funding model as described above, we implemented our strategy as demonstrated by the following major financing events:

Major Achievements in Financing Activities

CLP Holdings	**HK$10 billion bank facilities** • Irrevocable commitment with HK$5 billion 1-year and HK$5 billion 2-year facilities at competitive terms to fund the acquisition of a further 30% interest in CAPCO and remaining 51% interest in PSDC • Can be drawn in name of CLP Power Hong Kong at the same terms • Syndication of HK$5 billion in January 2014 with 12 multinational and regional banks in name of CLP Power Hong Kong **HK$500 million 3-year bank facility** • Arranged at favourable terms
CLP Power Hong Kong	**JPY12 billion (HK$934 million) 3-year syndicated bank loans** • Japanese yen proceeds were swapped back to Hong Kong dollars to mitigate foreign currency risk. Borrowing cost was lower than that of loans offered by Hong Kong based banks in the same tenor • Successfully syndicated to 13 regional and city banks in Japan with 1.5 times oversubscription • The first Japanese yen cross-border syndicated bank loan ever arranged in Japan for a Hong Kong borrower on a syndication basis **A$20 million (HK$161 million) 10-year bond** • Australian dollar proceeds were swapped back to Hong Kong dollars to mitigate foreign currency risk **HK$750 million 3-year bank loan facilities** • Arranged at favourable rates
EnergyAustralia	**Revised the terms of an existing A$700 million (HK$4.8 billion) working capital facility** • Extended maturity by one year to June 2016 with existing lenders at lower interest margin **Refinanced A$2.1 billion (HK$14.5 billion) syndicated debt facilities** • Refinanced the full amount and extended the maturities by an average of 1.8 years at lower interest margins • Finalised in Janurary 2014
CLP India	**Rs.6.5 billion (HK$816 million) short-term bank loan facilities** • Bridge finance the construction of various wind projects which will be replaced by long-term financing after construction completion
Chinese Mainland	**RMB750 million (HK$961 million) 13-year project loan** • Long-term project level loan to fund construction of the Jinchang Solar (51% CLP owned) at competitive rate **RMB215 million (HK$275 million) 10-year project loan** • Long-term project level loan to fund construction of Laiwu Phase I Wind Power project (CLP wholly owned) at competitive rate

Holistic View of CLP's Financing Model

Spreading out of maturities, no concentration of geographical and (re)financing risks

Diversified funding sources, multiple debt instruments and investors base

Long-term, diversified, quality partners in financial markets; business counterparties that have good local market knowledge; a well-balanced business portfolio to grow

Diversified Debt Profile

The benefits of a well-diversified debt profile may not be obvious in a normal market. Well-managed liquidity and (re)financing risks along with cost effective third party funding; spreading out of debt maturities; and diversified debt instruments, lenders and markets can enhance shareholder value.

Intangible Asset

Long-lasting, strong and mutually-beneficial relationships with lenders / investors and good credit ratings enable CLP to have continuous access to capital at competitive rates, particularly at times of high volatility, tightened liquidity and upsurge in borrowing costs.

Strong Financial Matrix

Our healthy business profile with diversified investments, strong balance sheet, relatively low debt gearing level, prudent financial and treasury management policies help deliver stable earnings and protect us from financial market turmoil.

Good investment grade credit ratings, respectful business practices, open and transparent dialogues with stakeholders, good credentials

Disciplined investment, financing and risk management strategies

Low debt gearing, non-recourse project level loans

Financial Risk Management

To deliver on our business objectives, safeguard our financial health and preserve our ability to grow into the future, we adopt a long-term, prudent approach to financial risk management. This involves balancing the needs of our various stakeholders to deliver shareholder value. Our initiative to hedge a high level of foreign exchange and interest rate exposure in our business portfolio is but one example of this, allowing us to avoid undue tariff volatility, even though a significant portion of this risk could be passed-through to customers.

Our financial derivative positions are established only to hedge genuine economic exposures. We also perform periodic reviews of derivative positions to meet business requirements. We adopt cost-efficient, plain vanilla and Hong Kong Financial Reporting Standards hedge effective derivative instruments in protecting earnings, without undue profit or loss impact. We also review our risk management policies and guidelines to ensure they meet our business requirements. We believe such an effective, highly-disciplined, and uncomplicated approach offer a high level of comfort to our stakeholders.

Liquidity

Though CLP Group is highly liquid (about HK$38 billion undrawn bank facilities and internal resources at end 2013), we are equally risk averse. We recognise that fluctuations in the markets may occur at any time, and to this end, we carefully plan for and assess liquidity requirements well in advance of our requirements from diversified sources. Our objective is to maintain a high level of liquidity at the most cost-efficient terms. The HK$10 billion bridging loan for the CAPCO / PSDC acquisitions is but one example of how we will arrange committed, specific debt funding for a major transaction notwithstanding our good liquidity position.

More Q&A on Financial Capital

Foreign Exchange and Interest Rate

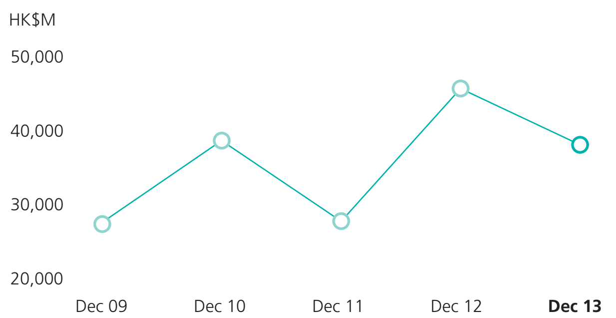
CLP continues to maintain a clear and coherent approach to hedging which is carried out with pre-approved financial institutions. Our Group companies enter into such arrangements only with financial institutions that we believe are able to perform their obligations over the entire tenor of our economic exposure.

Each of the financial risks and the associated mitigation measures are discussed in detail under "Financial Risk Management" in the Financial Statements on pages 241 to 252.

Refinancing Risks

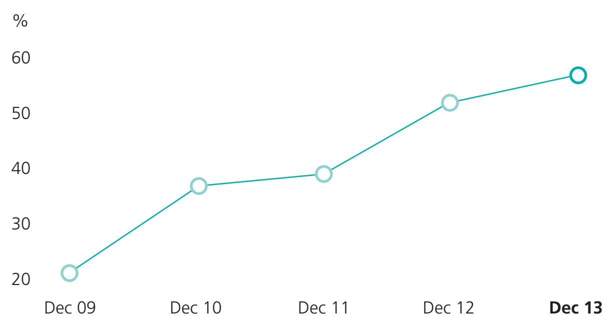
We maintain long-lasting relationships with our investors/lenders, cultivate relationships with potential lenders and consistently look for new opportunities to further diversify our debt portfolio to reduce refinancing risks. Our highly-disciplined investment and borrowing strategy, carefully monitored debt gearing ratio and prudent strategies to spread out debt maturities (ratio of debt with maturities beyond 5 years has increased from about 21% to 57% from 2009 to 2013) to the extent possible to match the long payback periods of our assets help us deliver attractive returns.

Firepower



Note: Firepower is the undrawn facilities plus bank balances, cash and other liquid funds.

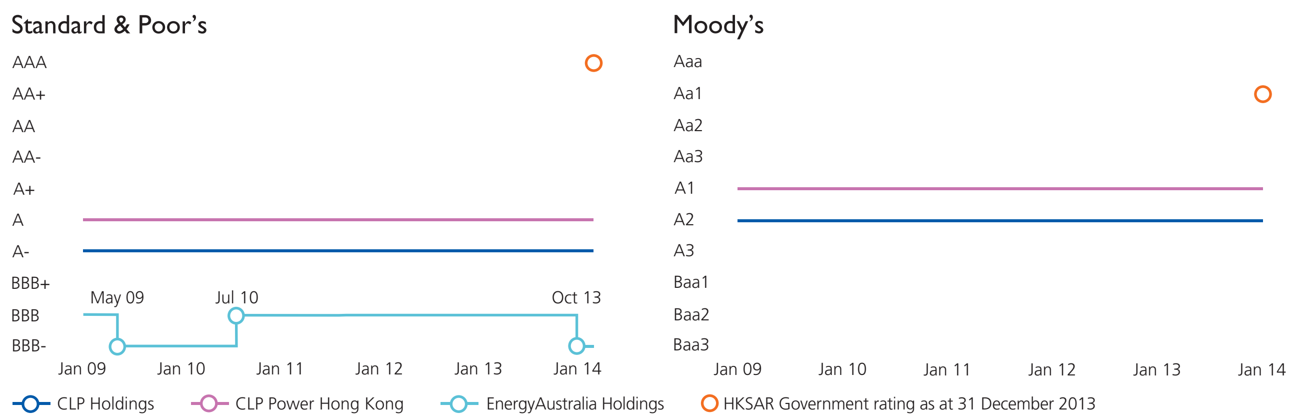
Ratio of Debt with Maturity Beyond Five Years to Total Debt



Credit Ratings

CLP always strives to maintain good investment grade credit ratings. 2013 is unique because of two credit rating developments in our Group companies. Firstly, the credit ratings of CLP Holdings and CLP Power Hong Kong were put on watch by Standard & Poor's (S&P) and Moody's in November with negative implication following CLP's announcement of the proposed acquisition of a further 30% interest in CAPCO and the remaining 51% interest in PSDC. This is not unexpected as rating agencies usually issue a ratings watch after the announcement of major transactions by a rated entity. We are closely working with S&P and Moody's to explain the rationale of the transaction, along with business and financial implications of the acquisition. Secondly, EnergyAustrlia's credit rating by S&P was revised to BBB- with negative outlook from BBB with negative outlook in October 2013. EnergyAustralia is maintaining an active dialogue with the rating agency on the subject.

Long-term Credit Ratings – Foreign Currency and Local Currency



CLP Holdings

Moody's: Re-affirmed the A2 credit rating with stable outlook in March 2013. On 19 November 2013, Moody's revised the outlook of the A2 rating to negative from stable after the announcement of the planned CAPCO and PSDC acquisitions.

Positives	Negatives
• Sound liquidity profile and good operating track record • Strong and predictable cash flows from CLP Power Hong Kong • Ability to assess domestic and international bank and capital markets • Well-managed debt maturity profile • Availability of sizeable committed bank facilities	• The proposed CAPCO and PSDC acquisitions add pressure to CLP Holdings' financial profile and reduce headroom for their financial metrics • Weak operating performance in Australia and India • Projected credit metrics will be marginal for the current rating if the acquisitions are largely debt-funded • Growing overseas and non-regulatory business investments increase risk profile and weaken CLP Holdings' financial profile • Expansion into riskier, non-regulated electricity and retail businesses in the region raises overall risk

S&P: Re-affirmed the A- credit rating with stable outlook in February 2013. On 19 November 2013, S&P placed the A- rating on credit watch with negative implication after the announcement of the planned CAPCO and PSDC acquisitions.

Positives	Negatives
• Strong business risk profile and modest financial risk profile • Expect financial strength to improve meaningfully from 2014 due to: (1) higher returns from Hong Kong operations; and (2) higher earnings from its Australian operations due to integration of New South Wales assets by the end of 2013 • Strong financial flexibility because of good access to bank facilities and capital markets • Adequate liquidity supported by strong operating cash flow from Hong Kong operations • Commitment to deleveraging and disposing assets to optimise the portfolio	• Proposed debt-funded acquisition by CLP Power Hong Kong could further weaken financial strength of CLP Holdings • Weakened business and financial risk profiles of EnergyAustralia • Entrenched fuel shortage in CLP's Indian power generation business • Expanding Asia Pacific power investments tempers the strengths that CLP Power Hong Kong brings and increases CLP Holdings' business and operating risks • New generation facilities under construction in Asia Pacific carry higher operating risks and introduce execution and integration risks to the Group's operations

EnergyAustralia

S&P: Lowered the credit rating to BBB- with negative outlook from BBB with negative outlook in October 2013.

Positives	Negatives
• Track record of support from its higher rated owner, CLP Holdings • Strong liquidity profile	• Weakened business and financial risk profiles resulting from relatively higher operating costs, continued delays in stabilising its retail billing platform, declining demand trends, and soft electricity price trends that will likely constrain near to medium term profitability • Challenging electricity trading conditions due to adverse trends in market demand and supply • Underperformance of its assets and its inability to reduce costs to offset expected continued weakness in the market • Transition of New South Wales customers to its retail platform will be critical to cost reduction

CLP Power Hong Kong

Moody's: Re-affirmed the A1 credit rating with stable outlook in March 2013. On 19 November 2013, Moody's revised the outlook of the A1 rating to negative from stable.

Positives	Negatives
• Planned CAPCO acquisition will improve CLP Power Hong Kong's credit profile as it will better integrate its power operations • CAPCO is a high quality generation asset through its long operating track record and favorable regulatory environment • Cash flow predictability supported by a well-established regulatory regime • Sound liquidity profile and a good operating track record • Good track record in accessing domestic and international bank and capital markets • Well-managed debt maturity profile • Projected financial profile remains strong	• Planned CAPCO acquisition creates uncertainty to the strong financial profile • Rating constrained by the weaker credit profile of CLP Holdings, owing to its increased exposure to risky non-regulated electricity and retail business in the region • Ratings of CLP Power Hong Kong and CLP Holdings are closely linked. A material deterioration in one of the companies could lead to rating pressure on the other • Liquidity profile may be pressured to a certain extent by its dividend payments to CLP Holdings as well as its long-term capital expenditure plan

S&P: Re-affirmed the A credit rating with stable outlook in February 2013. On 19 November 2013, S&P placed the A rating on credit watch with negative implication.

Positives	Negatives
• Proposed CAPCO and PSDC acquisitions by CLP Power Hong Kong would improve the operational and management efficiency, facilitate stronger control over generation assets and allow better coordination of generation, transmission, and distribution businesses • Excellent business risk profile and adequate liquidity • Satisfactory operating record and modest financial risk profile • Sound bank relationship and good reputation in capital markets • Good liability management with diversified debt sources • Long-term gas supply agreement with PetroChina ensures the stability of gas supply	• Uncertainty surrounding the expansion of CLP Holdings in unregulated businesses outside Hong Kong partly offset the strengths of CLP Power Hong Kong • The Government's environment regulations could result in some uncertainty in mid to long-term operations and financing needs • New gas supply agreement results in more capital expenditure on the construction of infrastructure and associated facilities, and thus raises funding needs

NATURAL CAPITAL

Our respect for the environment

In powering our communities, we rely on nature's precious resources for our daily operations. Maintaining a high level of operational efficiency and conducting our business in an environmentally responsible way is not just our responsibility, but also creates value for CLP. We are mindful of the potential environmental impacts we can have upon nature, and maintaining a balanced portfolio of energy sources in line with environmental regulations and policies is a key part of this.

Environmental Policy, Standards, Systems & Processes

The CLP Group Environmental Policy Statement forms an integral part of our Value Framework.

To deliver on our policy and commitments, we adopt appropriate standards, systems and processes to monitor and manage evolving risks. Given the challenges in managing multi-jurisdictional regulatory regimes, we have adopted a two-pronged approach in developing Group-wide standards, including mandatory standards that must be applied across the Group, and voluntary guidelines to be applied where relevant regulations are not yet in place.

In 2013, we focused on preparing new environmental-related standards, ranging from environmental impact assessment requirements to data management. These are currently being reviewed internally, with formal implementation anticipated in 2014.

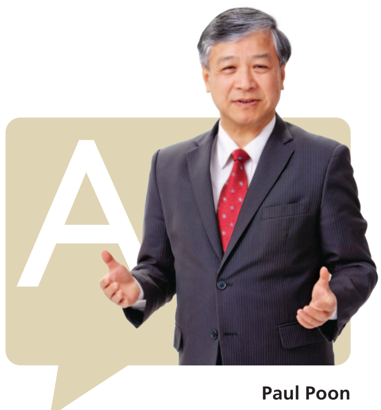
As part of our operational environmental risk management, all power generation facilities in which we have operational control (as defined by our CLP Group's Environmental Management System Certification Policy) must establish effective environmental management systems that conform to the globally recognised ISO14001 Standard and achieve third-party certification within 2 years from commencement of operation or acquisition.

Mr Or Wing Keung
Shareholder

The public is becoming increasingly aware of the health impact of hazy weather and air pollution. Restrictions on emissions by power plants and vehicles will inevitably be tightened. Longer term, will CLP only use natural gas or other clean energy to generate electricity?

We have been working hard to bring additional gas supplies to Hong Kong to increase its use for power generation and reduce pollutant emissions wherever we can. There is also the potential for nuclear energy to play a greater role. For the longer term, it is important to keep options open that allow for the flexibility to use a diverse range of fuels and generation technologies which will help to keep our generation costs lower in the longer run.

The Government is expected to relaunch a consultation on long-term fuel mix in the first half of 2014. Whilst we will do our best to minimise the cost impact of moving to a greater proportion of cleaner fuels, ultimately it will be the community that decides on where this balance should lie. With supportive and realistic policies and a stable regulatory framework, we can continue to help Hong Kong improve air quality.



Paul Poon
Managing Director
CLP Power Hong Kong

In regards to the above requirement, all assets under CLP's operational control reaching their two-year term in 2013 achieved ISO14001 certification on time. A detailed summary of the status of our environmental management systems, as well as environmental measures in place at facilities in which we have operational control as at 31 December 2013, is available in our 2013 Sustainability Report. SR

Performance on Group Environmental Goals

Within the CLP Group Sustainability Framework, under our key objective to "minimise environmental impacts", we have three aspirational Group environmental goals to move towards: (1) zero emissions; (2) a more sustainable rate of resource use; and (3) no net loss of biodiversity.

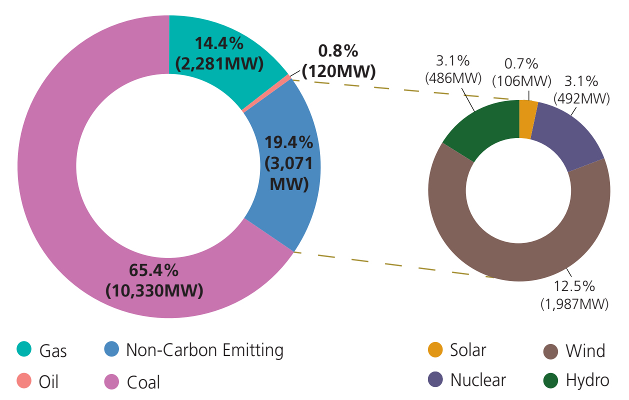
Our performance in these areas is summarised below.

Group Goal	Aspect	Group Highlights	2013	2012
Move towards zero emissions	**Greenhouse gases**	• Total CO_2 emissions (from power generation) • Carbon intensity (on equity basis)	44,076kT 0.82kg CO_2/kWh	38,319kT 0.77kg CO_2/kWh
	Air pollutants	• Total SO_2 emissions • Total NO_x emissions • Total particulate matter emissions	50.5kT 50.2kT 5.5kT	35.1kT 42.9kT 4.7kT
	Water discharged	• Total water discharged	5,000.8 Mm^3	4,665.7 Mm^3
	Waste	• Total solid waste produced • Total liquid waste produced	8,037T 1,228kl	11,092T 1,521kl
Move towards a more sustainable rate of resource use	**Fuel**	• Total coal consumed • Total gas consumed • Total oil consumed • Non-carbon % (on equity basis) • Renewable energy % (on equity basis)	433,763TJ 73,510TJ 1,973TJ 19.4% 16.3%	361,819TJ 86,200TJ 8,200TJ 23.8% 20.2%
	Water	• Total water withdrawal	5,031.0 Mm^3	4,689.6 Mm^3
Move towards no net loss of biodiversity	**Air/Terrestrial/ Marine**	**Group standard under development**		

Climate Vision 2050

In 2013, our Group carbon intensity increased for the first time since the publication of our *Climate Vision 2050* in 2007, rising from 0.77 kg CO_2/ kWh in 2012 to 0.82 kg CO_2/ kWh in 2013 (although we are lower than our starting point of 0.84 kg CO_2/ kWh back in 2007). This was due to a combination of factors. Firstly, the all-time low carbon intensity achieved in 2012 was a result of lower output from Yallourn Power Plant in Australia due to the disruption caused by the flooding of its mine, as well as the lack of coal for generation at Jhajjar in India. In 2013, the acquisition of the Mount Piper and Wallerawang coal-fired power stations in Australia, the increased output from the Jhajjar coal-fired plant in India relative to 2012, and our endeavours to align our carbon accounting method with our financial accounting definitions, which resulted in the removal of the CGN wind portfolio from our 2013 calculations, further exacerbated the increase in carbon intensity. Our renewable energy capacity in 2013 has also fallen to approximately 16% from over 20% in 2012. This was also due mainly to the acquisition of Mount Piper and Wallerawang. As a result, our non-carbon emitting generation capacity also fell to 19.4% from 23.8% in 2012.

CLP's Generation Portfolio – Energy Sources (Equity Basis)



When we first set our targets in 2007, we did anticipate that our carbon intensity would increase and peak at some point on the basis that power projects would mostly be fossil-fuelled driven in Asia Pacific over the next decade. However, we did hope that the momentum on managing climate change would build up fast enough so that this peak would happen earlier, thus enabling the development of more non-carbon emitting power projects, and allowing us more opportunities to continue along our decarbonising pathway. The Group's carbon intensity may still experience some fluctuations between now and our next milestone in 2020, but the general trend is expected to be downwards overall. We remain optimistic that our 2020 target of 0.6 kg CO_2 / kWh can be met.

Environmental Regulatory Compliance

In 2013, we had no environmental regulatory non-compliances that resulted in fines or prosecutions for any of our assets in which we had operational control.

It should be noted that operational exceedance may occur from time to time due to normal fluctuations of operational conditions, but may be more likely for new or ageing assets. As a good practice, these incidents are reported to the local environmental authorities for information only.

Beyond Compliance

Climate Vision 2050 Review

A review of our Climate Vision 2050 strategy and milestones was completed in 2013. Given the current uncertainties of the international climate change agreement under the United Nations Framework Convention on Climate Change, combined with ongoing global financial constraints, it was difficult to justify any further tightening of our targets. Although there is some optimism of more bottom-up momentum, whereby national governments may take action on their own like China, other countries such as Australia have seen a slowdown in such sentiments and political will. As a result, our targets will remain the same and we will strive to meet them even though at this point in time, we believe they are more ambitious than before.

Climate Change Adaptation

In 2013, we completed climate change adaptation assessments of three fossil-fuelled plants (Fangchenggang in China, Jhajjar in India, and Tallawarra in Australia) to explore potential adaptation measures that are needed. This was a continuation of the pilot study completed in 2010 for Paguthan and Ho-Ping, which tried to capture the lessons learned from operational disruptions that occurred due to extreme climatic events.

We commenced a third assessment in 2013 to begin exploring what adaptation measures may be needed, and are possible for our renewable energy assets. The assets covered in this phase of study included Jiangbian Hydro Power Station in China and Saundatti and Harapanahalli wind farms in India. Given the expansion of our renewable energy portfolio, the perception of such assets being more vulnerable to climate change and their relatively young history of operation, we believed it would be prudent to begin understanding these assets at an earlier stage and to commence implementing adaptation measures where appropriate and possible.

Tracking Emerging Regulations in the Chinese Mainland

To keep abreast of the fast evolving environmental regulatory developments, we established a comprehensive online Environmental, Health and Safety database, which is regularly updated and accessible to our power generation facilities. The list includes national and provincial environmental regulations, as well as city-level environmental regulations relevant to each power plant. We also commissioned a study to further understand the potential impact of China's changing environmental regulations on our business.

PM2.5

The PM2.5 issue has in recent years received considerable attention worldwide. In anticipation of potential regulatory control and reporting on PM2.5 emissions from power plants, we conducted a review on a range of related subjects including currently accepted and other proposed measurement methods, as well as the status of implementing PM2.5 policies and regulations in other countries.

HUMAN CAPITAL

Our people and safety performance

Throughout Hong Kong and across the Asia-Pacific region, the CLP Group employs over 6,900 people. In this section we describe how we leverage our human capital to deliver value to our shareholders by creating a sustainable organisation, aligning staff resources with our established strategic direction and focusing time and effort to manage material risks and to improve profitability of the Group.

Our business demands the highest attention to safety – year in, year out; day in, day out. Safety is, and remains, our absolute and number one priority. We have said this in previous reports, and we will say it again – electricity takes no prisoners. Nothing we can do for our colleagues compares with the importance of our duty to do our utmost to ensure that they go home safely from work every day.

This responsibility extends not only to our employees, but also to the staff of our contractors and to everyone who legitimately comes into our facilities. Our business would not survive if we overlook the safety of those who work within it. The CLP Group is committed to delivering world class safety performance and seeking continuous improvement in its safety systems with a long-term goal of zero injuries.

The Group's overall safety performance in 2013 for both employees and contractors is summarised in the table below. It explains the number of incidents involving lost time injury (LTI) and the rate of incidence for those assets under construction or in operation, where we have operational control or majority ownership. Lost Time Injury Rate (LTIR) and Total Recordable Injury Rate (TRIR) are industry standards for measuring safety performance. They refer to the number of lost time injuries or recordable injuries measured over 200,000 working hours of exposure, which generally equates to around 100 people working for one year.

Safety Performance

	Employees						Combined Employees and Contractors					
	2013			2012			2013			2012		
Location	No. of LTI	LTIR	TRIR	No. of LTI	LTIR	TRIR	No. of LTI	LTIR	TRIR	No. of LTI	LTIR	TRIR
CLP Holdings	0	0.00	0.48	1	0.48	0.48	1	0.29	0.88	1	0.45	0.45
Hong Kong	1	0.02	0.11	4	0.09	0.16	5	0.05	0.17	17	0.16	0.34
Australia	2	0.13	0.39	2	0.16	0.47	7	0.33	0.95	2	0.11	0.96
Chinese Mainland	1	0.11	0.45	0	0.00	0.00	2	0.07	0.21	0	0.00	0.17
India	1	0.17	0.34	0	0.00	0.23	17	0.39	0.77	9	0.18	0.48
Southeast Asia and Taiwan	0	0.00	0.00	0	0.00	0.39	1	0.21	0.21	0	0.00	0.11
Total:	5	0.06	0.23	7	0.09	0.21	33	0.16	0.39	29	0.14	0.40

The overall LTIR in 2013 was higher than 2012, partly due to three incidents at Jhajjar in India – two multiple LTIs and a fatality that involved a contractor working overnight. To determine the cause of the fatal accident and prevent reoccurrence, an investigation was completed by an independent panel, which subsequently proposed a range of improvement measures. CLP has adopted all the recommendations. In addition, we also engaged NOSA, the internationally recognised health and safety consultant, to conduct a NOSA 5-star safety training at Jhajjar and to assist Jhajjar in improving its safety performance.

Partly as a result of the two multiple LTIs mentioned above, 33 LTIs were recorded across the Group in 2013, up from 29 in 2012. LTIR increased 14% from 0.14 in 2012 to 0.16 in 2013, indicating a higher number of serious injuries reported across the Group. This rising trend is of concern and we are addressing it through the introduction of a NOSA auditing process at Jhajjar in the fourth quarter of 2013 and planned implementation in 2014 of a set of 10 Critical Risk Standards, which has been developed to specify the minimum level of safety across all CLP power stations in different countries.

The TRIR of 0.39 achieved in 2013 was slightly lower than 0.4 in 2012, meaning the total number of injuries reported was similar to a year ago. However, both the LTIR and TRIR for Hong Kong showed a marked improvement following implementation of life saving rules and continuous engagement with contractors on safety issues.

A Skilled and Experienced Team

	No. of Employees	Average Age
Hong Kong	4,394	44.8
Australia	1,745	38.1[1]
Chinese Mainland	360	39.5
India	469	34.8

Note:

1 Exclude Mount Piper and Wallerawang which were acquired in Q4 2013

Key to our businesses' sustainability is our ability to attract, retain and develop our people to support our business strategy. This requires a combination of competitive remuneration and benefits, and a culture that emphasises care for employees as a key priority. As a Group, we provide stable and secure employment for our staff with excellent opportunities for long-term career development. Our low voluntary turnover rates (compared to local market norms), together with high average length of service, are direct evidence of our success in retaining staff.

	Voluntary Turnover Rate (%)	Average Length of Service (years)
Hong Kong	1.9	18.5
Australia[1]	9.4	6.1
Chinese Mainland	2.6	14.9
India	10.1	5.2

Note:

1 Exclude Mount Piper and Wallerawang which were acquired in Q4 2013

Our Technician Trainee Programme offers a great start to a career in engineering

In addition, to enforce our business strategy, we need to position the right people in the right place. As we shift to a low carbon portfolio, this is reflected in increasing numbers of our generation asset staff being allocated to renewable rather than conventional fuel assets. For example, in 2013, 15 headcounts were added for new wind and solar projects in China. In India, we made material progress in reviewing employee and contractor staffing levels and aligning them with operational needs at Jhajjar.

People Development

We are committed to investing in the training and development of our people. The success of our people development is directly reflected in our high rates of internal promotion and the fact that the majority of senior vacancies are filled internally rather than through external recruitment. An excellent example of this is Paul Poon, Managing Director of CLP Power Hong Kong, who has risen through the ranks having first joined us as graduate trainee in 1974.

Apart from training and development initiatives organised at a local business unit level, considerable importance is placed on our Group level programmes, particularly as this enables us to:

- target key talent, helping to ensure we have strong succession plans in place for Senior Management across the Group;
- provide networking opportunities for individuals who may not otherwise have the opportunity to work together, assisting to foster relationships and build a shared culture across the Group; and
- expose individuals to different market dynamics, for example how competitive energy markets differ from regulated markets.

Examples of Group-level and local programmes organised in 2013 are:

- A group executive development programme run in conjunction with the Institute for Management Development (IMD), whereby 22 selected colleagues from across the Group with high leadership potential undertook a course focused on developing personal leadership capabilities.
- In EnergyAustralia, visiting professors from the US and Europe provided strategic insights into the most recent global leadership thinking on innovation and customer service leadership. In addition, a Melbourne professor presented a master class on strategic change based on his past 20 years of global study tours of world-class organisations.
- In India, the individual development planning process has been streamlined and a learning effectiveness process was introduced.

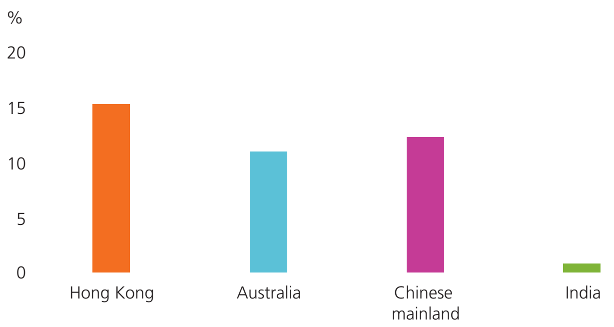
At the same time, we recognise that the greater part of individual development comes from stretching on-the-job experiences. This includes international movement in some cases, which also helps us leverage our skills across the Group. For example, to prepare for receiving new gas from WEPII, a gas expert was seconded from EnergyAustralia to help train our engineers in Hong Kong and develop procedures to ensure safe and efficient operations.

In the Chinese mainland, some of our assets share management and functional resources regionally, which is both cost effective and provides staff development opportunities. For example, the Jiangbian hydro project provides management and functional support to our new solar plant in Jinchang.

Preparing for the Future

Like many large organisations, we face the challenge of an ageing workforce, which reflects a broader trend of demographic changes and ageing populations in developed economies. This is also a common feature of utilities, reflecting low turnover and high average length of service. To plan ahead for this, we carefully monitor our retirement projections and ensure that we have mitigation plans in place. These include succession planning and the annual recruitment of graduates and apprentices. To support our succession planning process, in 2013 we continued to make a significant investment in developing identified successors and other high potential staff. In Hong Kong, 82% of the staff movements we had planned as part of our Management Development and Succession Planning cycle were achieved. At the same time, to enhance the performance of our employees in their current roles and to prepare them for the future, our average training days per head were 5.5 in 2013 (5.6 days in 2012).

5-year Retirement Projection



Notes:
1 Employee numbers (full time staff only)
2 All Australia figures exclude Mount Piper and Wallerawang which were acquired in Q4 2013

Our retirement projection varies from region to region and is currently highest in Hong Kong. Whilst our competitive remuneration and benefit policies allow us to replace retiring staff through recruitment, this is more difficult for engineers in Hong Kong, given competition from large numbers of capital projects in the region and the reducing numbers of school leavers enrolling in engineering courses. Consequently, we need to plan ahead systematically to focus on engineering recruitment.

Examples of initiatives implemented in Hong Kong in 2013 to ensure the adequate future supply of engineering talent are listed below:

- More than 60 graduate trainees, technician trainees and craft apprentices were recruited.
- The CLP Executive Engineering Programme was launched to identify and develop high potential engineers for our leadership team succession.
- We continue to build partnerships and collaboration with academic institutions including the University of Hong Kong and the Vocational Training Council to nurture future engineers.

Compared to Hong Kong, Australia has a higher staff turnover rate particularly in call centres. Consequently, EnergyAustralia has implemented a recruitment process outsourcing model that significantly reduces cost and time associated with these activities. This also facilitates a better understanding of the talent available in the market.

Our workforce in India is relatively young. In addition, our business context in India means that there is no requirement for extensive recruitment currently.

CLP's Junior Green Engineer Programme brings together engineering, scientific and environmental education themes to nurture a new generation of green pioneers

SOCIAL AND RELATIONSHIP CAPITAL

Our values, reputation and community initiatives

CLP's Value Framework

Even though societies, governments, politics and technologies change, our core values, which have been integral to our success over the past century, remain unchanged and will continue to guide us into the future. As an organisation, we sometimes need to make tough decisions which impact our colleagues and the community at large. Our core values ensure that such decisions are made fairly and ethically, balancing the economic, social, and environmental dimensions of our business and the interests of our shareholders and other stakeholders.

Expressed formally in our *Value Framework* and first published in 2003, our core values have been integral to building and protecting CLP's reputation. Our *Value Framework* states our vision, mission, core values, commitments, policies and our Code of Conduct. It is the bedrock of our corporate culture and the foundation of our reputation.

Our Value Framework is not a manifestation of the work we do to fulfill our mission – it defines the values that underpin our strategy and operations, the standards by which we expect everyone in the CLP Group to conduct themselves, and how we interact with our stakeholders to achieve our vision. In other words, it is an articulation of our beliefs, and how these beliefs drive our behaviour as we strive to earn and sustain trust and support from our stakeholders.

VISION	CLP's vision is to be the leading responsible energy provider in the Asia-Pacific region, from one generation to the next.
MISSION	In a changing world, our mission is to produce and supply energy with minimal environmental impact to create value for shareholders, employees and the wider community.
VALUES	Our values guide us in fulfilling our mission and turning CLP's vision into reality.
COMMITMENTS	Our commitments are the promises that we make to our stakeholders about the way in which we will uphold our values.
POLICIES & CODES	CLP's policy statements aid in the articulation and incorporation of our values and commitments into our everyday operations and practices.

CLP's Value Framework

In this section of the Annual Report, we will briefly explain the ways in which we bring these values to the markets in which we operate, and how our interactions with the community are designed to strengthen our reputation and community acceptance of our activities.

Community Initiatives

Our community initiatives aim to contribute to society through improving the quality of life for the communities in which we operate. Given the diversity and location of our assets, we take a country and site-specific approach to our community activities. Examples of our tailored programmes for each region can be found in the Performance and Business Outlook section and our Community Investment Report, which provides extensive information of these activities.

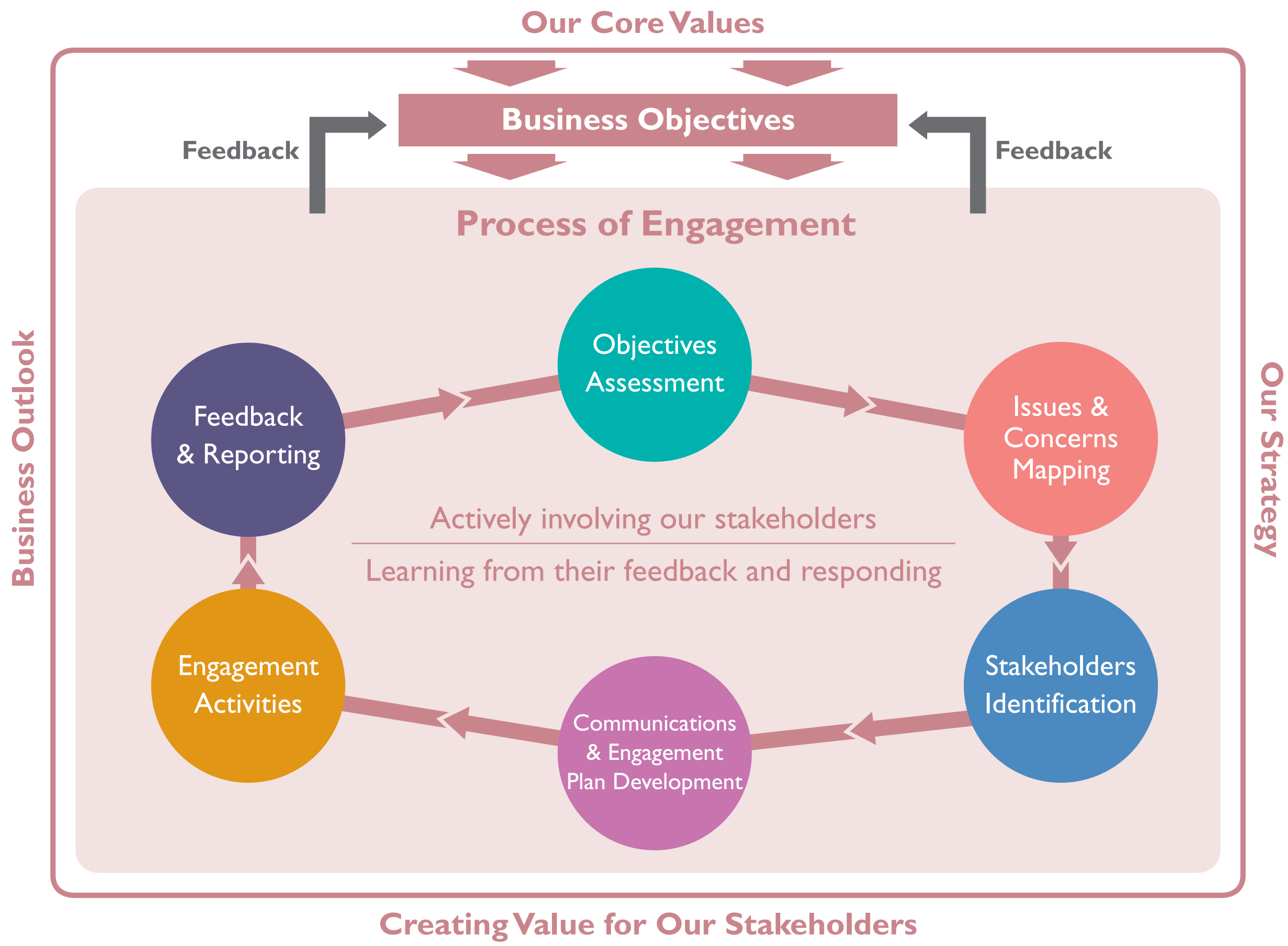
As with any investment that CLP makes, we seek to allocate our resources in a disciplined and systematic way. In 2013, we introduced a Community Investment, Sponsorship and Donation Policy, providing a framework for all business units in their design, implementation and execution of community initiatives. We are confident that selected programmes, carefully chosen, thoroughly implemented and carefully monitored, will enhance our reputation and relationships.

Stakeholder Engagement

Our business units regularly meet with members of the community to listen and understand their views of our operations. These two-way dialogues help us learn about community needs and assess the best way to leverage our resources to contribute to future community development.

While the utility business may be viewed as a local one, we recognise the importance of strengthening our relationship with global leaders as a means of keeping abreast of emerging cross-border issues, and to contribute to wider policy debate at both local and international levels. At the CLP Group level, we complement our business units' efforts by working with international organisations and universities, both to enhance general understanding of the the power sector as well as strengthening our understanding of the material impacts that CLP's operations have on communities.

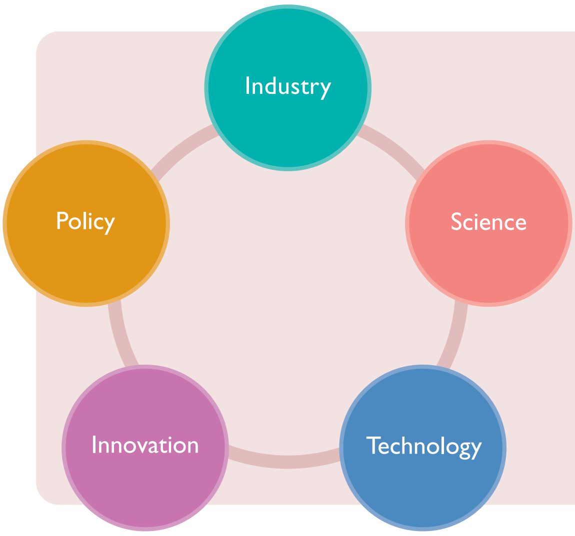
Stakeholder Engagement Strategy



Electricity touches many aspects of our lives. It powers the development of society and contributes to a better quality of living. Yet the electricity business has national security, environmental, public health, economic and social implications. At the operational level, the power sector also touches upon science, technology, innovation, and policy. We recognise that a diversity of solutions, and support from our stakeholders, including governments, shareholders, capital providers, customers, suppliers – are all necessary in formulating energy policies. Consequently, a bulk of our work is focused on facilitating and participating in the dialogue across the private, public and civil society sectors, advocating for carbon and clean energy policies, exchanging best practices, and monitoring emerging issues confronting the sector. These engagements have and will continue to enable CLP, and our stakeholders, to understand the opportunities and risks presented within an evolving landscape and assist us in making informed decisions as we decarbonise our portfolio.

Recognising the role of the power sector in climate change, in 2007 we announced our *Climate Vision 2050*, setting our goal of gradually lowering the carbon intensity of our portfolio. With clean energy playing an important role in enabling us to meet our carbon intensity reduction goals, our executives continue to exchange views with numerous organisations to expand our stakeholders' understanding of the renewable energy sector. Through proactive knowledge sharing with

Strategic Advocacy and Stakeholder Engagement



- Bloomberg New Energy Finance
- Electric Power Research Institute
- Institute for Environmental Research and Education
- International Council on Large Electric Systems
- International Energy Agency
- MIT Joint Programme on Science and Policy of Global Change
- The Climate Group
- Universities e.g. Hong Kong University of Science and Technology, Tsinghua University
- World Business Council for Sustainable Development
- World Energy Council

Ir Ricky Leung
General Manager – Airport Authority

I participated in the CLP Power Hong Kong Green Building Symposium 2013. It was a remarkable event, and a great platform for green building experts, management offices, occupants and other stakeholders to share their challenges and experiences. Will CLP continue to organise events like this? In the event, I have learnt that CLP is developing different energy saving initiatives for customers. Does CLP have anything to help a large organisation like us?

As part of our ongoing commitment to a greener environment, we will definitely be organising similar events to promote EE&C in the future. In addition to our first Green Building Symposium, we also hosted our first Data Centre Symposium in November 2013. This provided a platform to promote best practices in energy management as well as highlighting the ongoing challenges associated with operating data centres in a sustainable and environmentally friendly manner.

We are continuing to develop numerous EE&C measures for our customers. Our enhanced Meter Online Service was unveiled in 2013 and now provides an advance "7-day Energy Forecast" based on the latest weather information. To better manage operation of chillers and air-distribution systems in buildings, we are also developing an energy service to assist building owners and operators to achieve energy saving, without sacrificing comfort.

Quince Chong
Chief Corporate Development Officer

policymakers, regulators and capital providers, we are confident that better market conditions and regulations will achieve our vision of sustainable energy for all.

Complementing our work around climate change, sustainability and corporate governance, our involvement with reporting and governance institutions enables us to contribute to the debate on emerging frameworks and shape the agenda in these areas. Some key advocacy efforts and activities in 2013 included:

- continuing our advocacy efforts on clean energy policies through organisations such as The Climate Group, the Bloomberg New Energy Finance Summit and The First Global Investor Forum on Climate Change;
- organising the first Asia meeting of the San Giorgio Group, bringing together development agencies, policy makers, capital providers, project developers and investors, to develop solutions to promote green financing in Asia;
- contributing our management team's expertise to studies initiated by industry groups, such as the International Energy Agency, on energy technologies, including smart grids and energy storage;
- contributing to the World Energy Council's policy dialogue paper on how to succeed in overcoming the challenges of the energy trilemma: energy security, energy equity, and environmental sustainability;
- supporting sustainability research and development, primarily through our participation in working groups led by the World Business Council for Sustainable Development;
- supporting an energy symposium at the City University of Hong Kong, bringing in a network of international expertise to foster discussion about energy choices for Hong Kong;
- conducting our first webcast to explain our environmental, social and governance (ESG) performance and how this contributes to our overall financial performance, informing the way in which we will report on ESG issues as we apply the HKEx ESG guidelines;
- supporting the development of a corporate governance toolkit for the training of corporate secretaries in developing countries through the Corporate Secretary International Association; and
- supporting efforts of the International Integrated Reporting Council and the Hong Kong Institute of Certified Public Accountants' to strengthen capacity on integrating ESG into annual reporting cycles.

Communicating openly with our stakeholders is a core tenet of CLP's Value Framework. As we continue our journey to powering Asia responsibly, we will continue to share clear, comprehensive, fair and accurate information on our operations to our stakeholders.

EnergyAustralia supports the promotion of swimming safety for children

INTELLECTUAL CAPITAL

Our expertise

In our 2012 Annual Report we identified a range of technology choices available for power generation in CLP's markets. Our expertise and experience in developing and operating projects forms part of the "intellectual capital" of CLP's business. This year we have taken our previous table of technology choices and used examples from 2013 to demonstrate our expertise in action.

CLP Technology Roadmap

1 Australia Wind

- We sold a 75% interest in Waterloo Wind Farm, while retaining the right to operate and manage it.

2 China Wind

- Our wholly-owned Laiwu Phase I commenced operation in January 2014.
- Final-stage development work continued for Xundian Phase I and Laizhou Phase I wind projects, as we continued to seek approval for Huadian Laizhou Phase II.

3 India Wind

- Three new wind projects – Sipla, Bhakrani Phase I and Mahidad Phase I – entered service.
- We commenced construction of Yermala and Jath.

4 Lopburi Solar

- We completed an expansion of 8MW to the Lopburi solar photovoltaic project, bringing the total capacity to 63MW. CLP has a one-third equity share and provided management leadership and technical support for the construction and operation of the project.

5 China Solar

- We commissioned our first solar photovoltaic project in Jinchang, which has a tracking system to align the solar panels to the changing angle of the sun to increase output.
- We have also received approval for a second solar project in Xicun, with construction to be commenced in the first quarter of 2014.

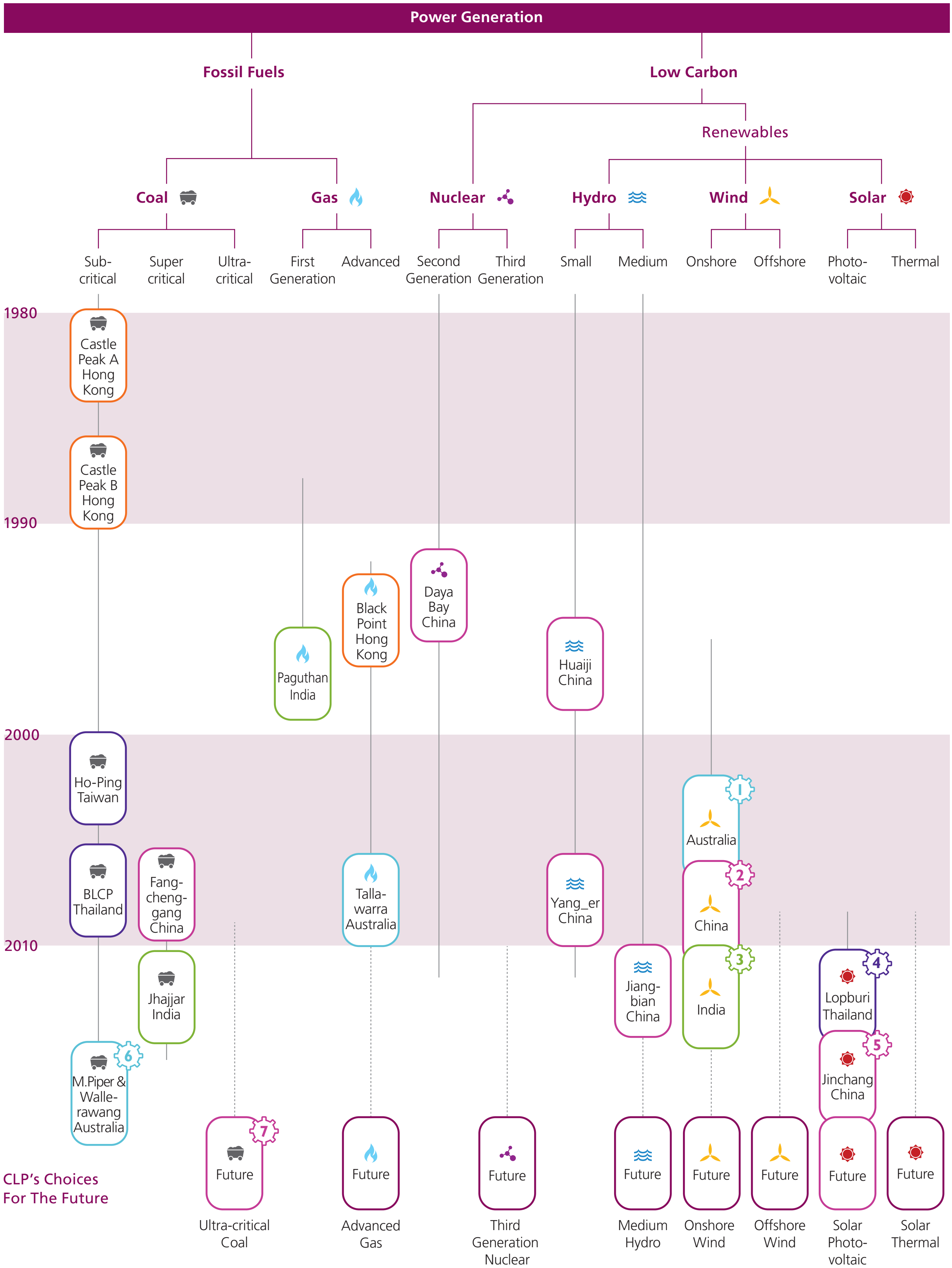
6 Mount Piper and Wallerawang

- We acquired direct ownership of the two power plants in New South Wales.

7 Fangchenggang II

- We are developing a second stage to the Fangchenggang project that will use ultra-supercritical technology.
- CLP will act as the project manager and operator. We hope to receive final approval in the first half of 2014, with full construction to commence as soon as the final consent is granted.

CLP's Choices of Technology – Past, Present and Future



CLP has been developing renewable energy projects in the Asia Pacific region for almost a decade. In the following section, we discuss our views on the potential for renewable energy.

The potential for renewable energy

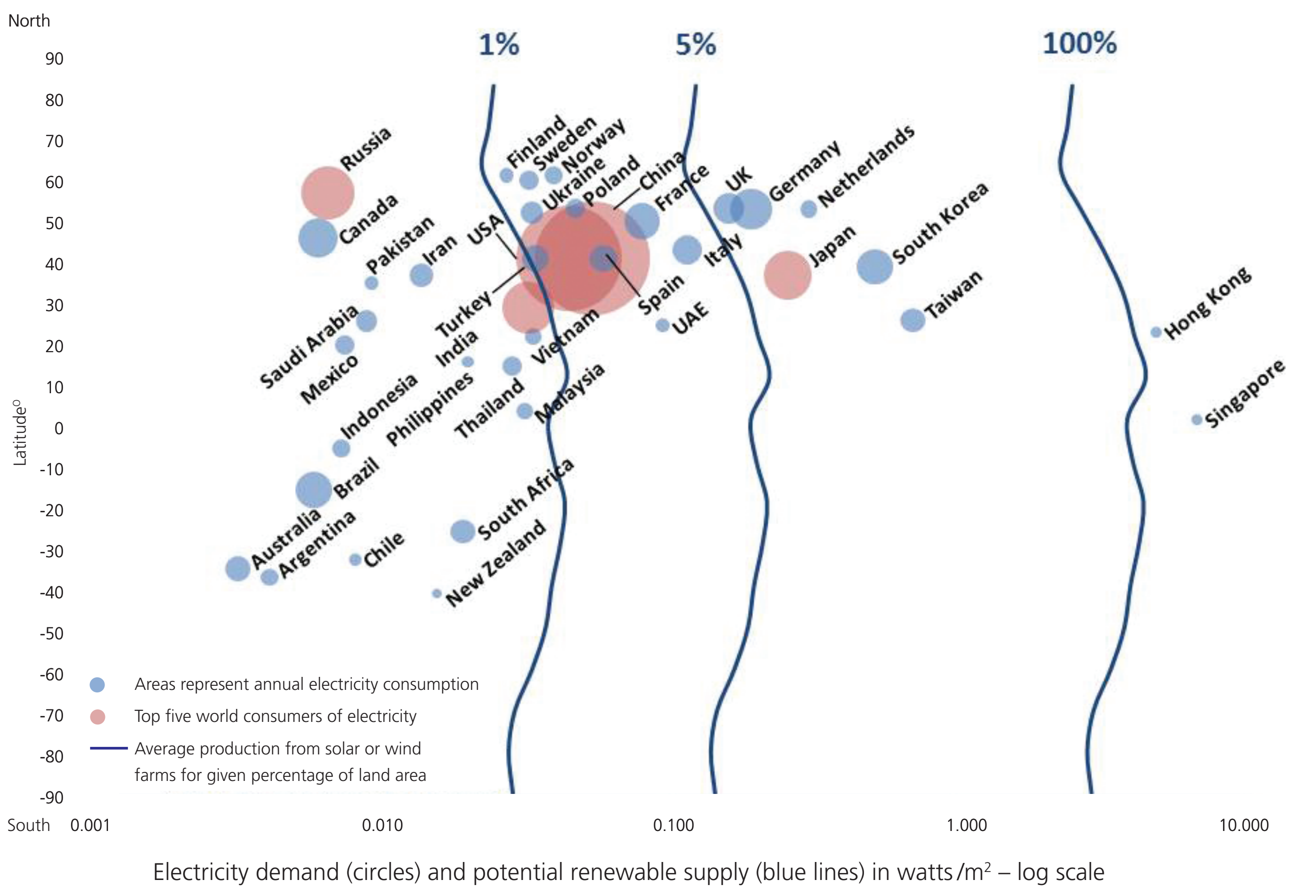
Most of the fuels we currently use for power generation are economic and reliable, but not sustainable in the long term due to their carbon intensity and contribution to climate change. Coal is the most affordable but emits the most carbon. Natural gas is expensive and still has too much carbon to be a long-term solution. Nuclear power does not emit carbon but public acceptance remains an issue. So what alternatives do we have?

There is a certainly vast quantity of energy in the wind and in solar radiation and we consider here how much of it we can convert into electricity and whether these renewable sources could replace conventional forms of power generation.

It turns out that a typical wind farm will produce, on average, around 2 watts of electricity per square metre of land. Solar photovoltaics do somewhat better at around 5 watts per square metre (See note on page 107 for wind and solar farm output calculation methodology). These figures seem low but they take into account the obvious problem that wind speed and solar intensity are variable and intermittent. Less obviously, large wind turbines need to be separated by some hundreds of metres to avoid the wake from one affecting others. Even solar panels need to be well spaced, particularly if they are angled towards the sun, otherwise they will cast shadows on each other. The panels themselves typically cover less than half the area of a solar farm.

Even so, renewables can still produce impressive amounts of energy if we have sufficient land available. We can calculate how much of its land each country or region would need for wind or solar farms to supply all its electricity.

What Percentage of a Country's / Region's Land is Needed to Supply All Its Electricity from Wind or Solar Energy?



Electricity demand (circles) and potential renewable supply (blue lines) in watts /m² – log scale

Sources: CLP and NASA

Australia, Russia, Canada and many others could generate all their electricity from wind or solar farms using a fraction of one percent of their land area. China, India and even the US could do so if they were prepared to allocate up to 2% of their land. At the other extreme, it will probably be impossible for countries such as Japan, the UK and Germany to find enough land to generate all their electricity from renewables, though they might look offshore for other sources of clean power.

Densely populated urban environments such as Hong Kong and Singapore do not have enough land area available to generate a significant amount of their electricity from renewable energy and would have to explore the possibility of imports from adjacent regions.

Renewable energy is currently more expensive than fossil fired sources, though the cost has gradually fallen as the technology improves and the market grows. There needs to be a wider dialogue on how rapidly society can accept a transition to new forms of energy that may have a higher cost and will require the use of significant land resources, but that will be sustainable.

The issues described here will affect each country/region's policy on renewable energy and the opportunities available for CLP to develop renewable projects. China, India and Australia all have viable wind and solar resources, and adequate land areas. We have become a leading developer, investor and operator of wind farms in these markets and we are now starting to develop solar projects. There is clear potential for continuing growth. However, the smaller Southeast Asian countries are more constrained and fewer opportunities have emerged so far.

Hong Kong, on the other hand, is a small and densely populated territory with severe competition for scarce land. There will be some opportunities for renewable generation that should be examined, no matter how small. However, the need for large areas of land to collect meaningful amounts of energy from the wind or the sun means that it will never be possible to generate a significant part of our electricity supply from renewable sources located within Hong Kong.

Note: Wind and solar farm output calculations are averaged over the long term, taking the total energy that can be produced in a year (including zero output at night and full output only occasionally, given the right climatic conditions). Effective annual output is then divided by the total land area used to give an average output in watts/m^2. Note that the land area of a wind or solar farm is much greater than the area occupied by the wind turbines or solar panels alone.

Jinchang Solar in the Chinese mainland, our first majority-owned solar project, occupies 468 hectares of land (equivalent to about 3,744 Olympic-sized swimming pools)