Powering for the Future – Application of Energy Efficient Facilities and Renewables in Buildings

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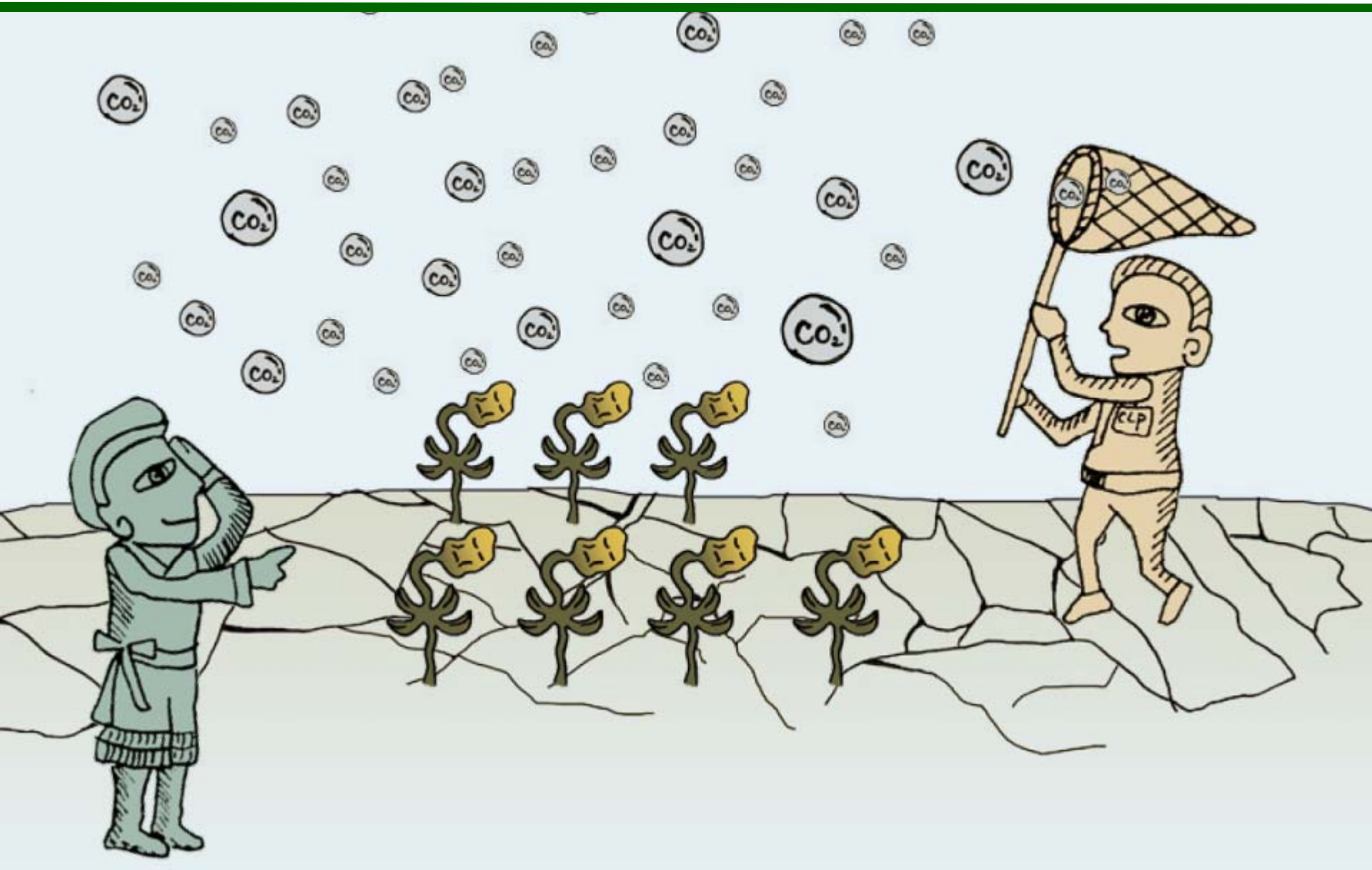
CLP Power Hong Kong

Part I : CLP's Environmental Commitments



CLP's Climate Vision 2050

Towards The Future	CO_2 Emissions Intensity	Non-carbon Emitting
2004		<1% (renewables)
2007	0.84 (kg CO_2/kWh)	
2010	0.8 (kg CO_2/kWh)	5% (renewables)
~5%		
2020	0.7 (kg CO_2/kWh)	20% (non-carbon)
>45%		
2035	0.45 (kg CO_2/kWh)	Ongoing Review of Target
>75%		
2050	0.2 (kg CO_2/kWh)	

By

Energy Efficiency & Conservation

Renewable Energy

Natural Gas

Nuclear

Clean Coal

2010 (end Q1):
- ~11% renewables
- ~15% non-carbon

CLP's Renewable Portfolio (Operational and Under Construction)

China (845MW)

- *22 wind farms (463 MW)*
- *3 hydropower projects (371MW)*
- *1 biomass plant (11MW)*

India (446 MW)

- *6 wind farms in India (446 MW)*

Australia (142 MW)

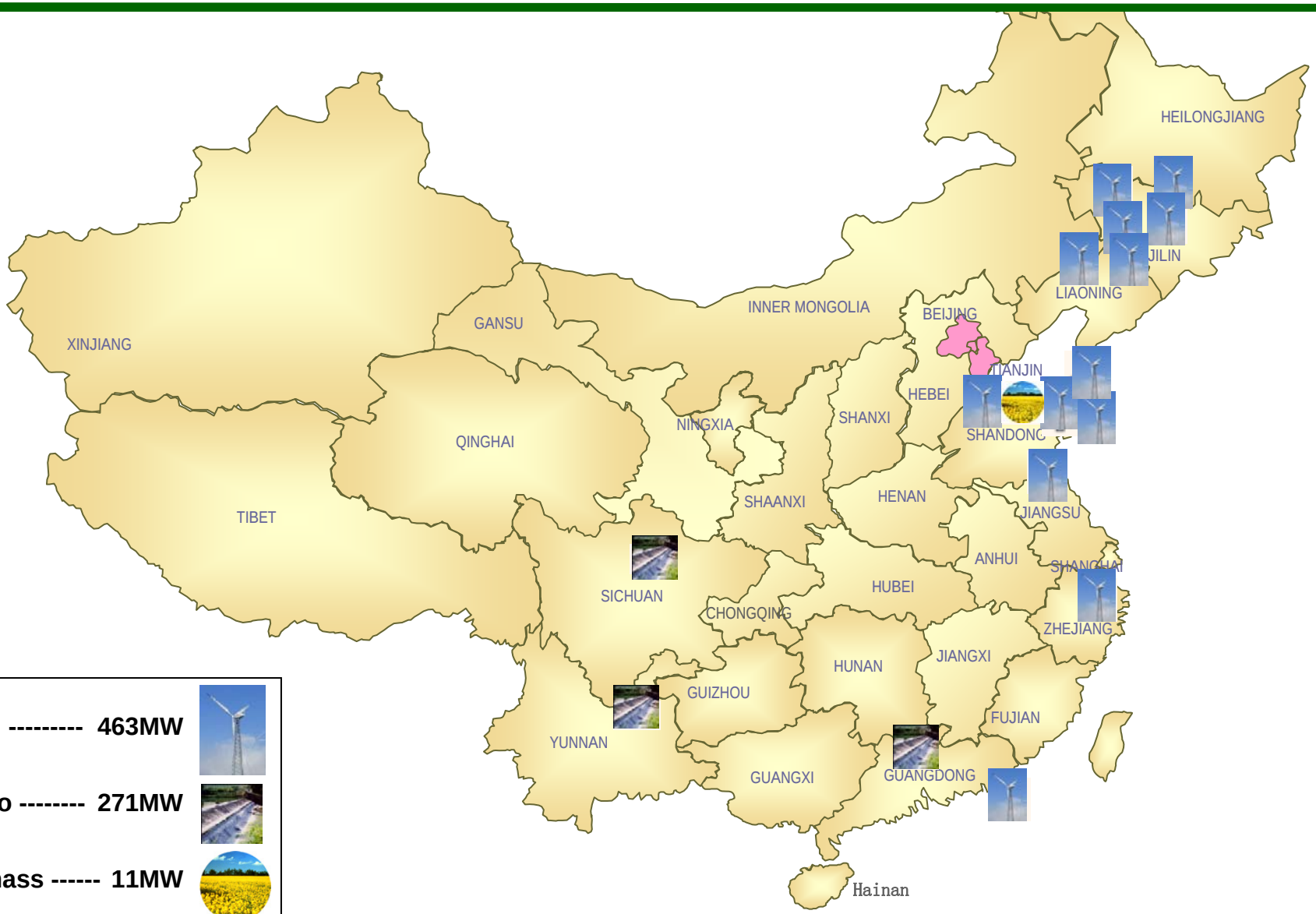
- *4 wind farms in Australia (142 MW)*

Southeast Asia (39 MW)

- *1 hydropower project in Laos (36MW)*
- *3 plants in Thailand (3MW)*

About 1,472 Equity MW (over 11% of total generating capacity)

CLP is the largest foreign investor in renewable energy in China



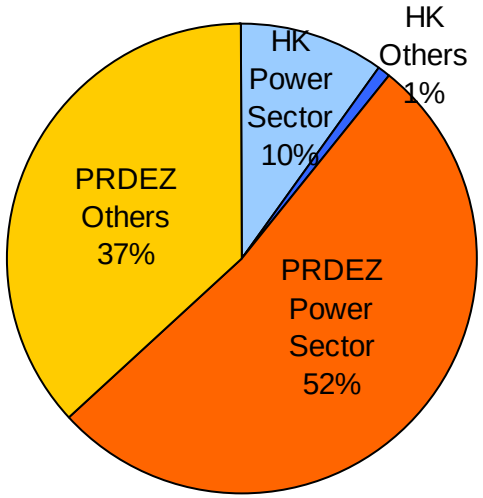
Wind --------- 463MW

Hydro -------- 271MW

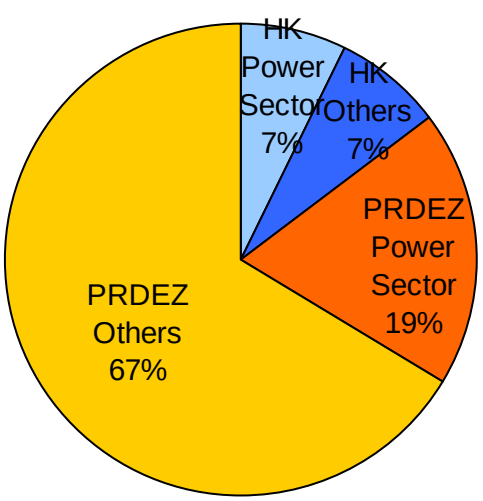
Biomass ------ 11MW

Regional Power Sector Emissions

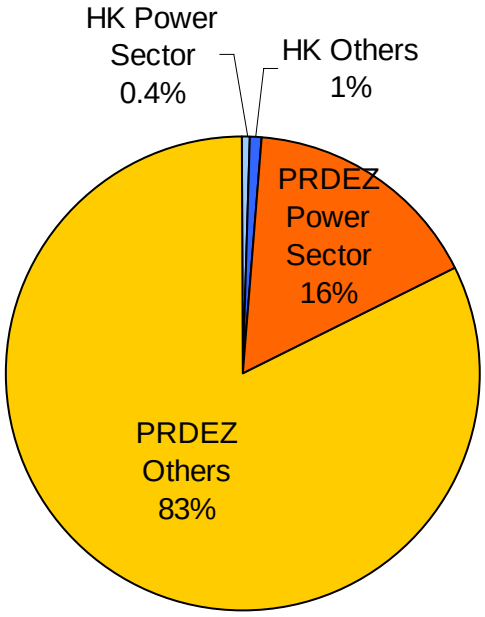
Hong Kong & Pearl River Delta Economic Zone (PRDEZ) – 2003 Regional Emissions



SO_2



NO_x



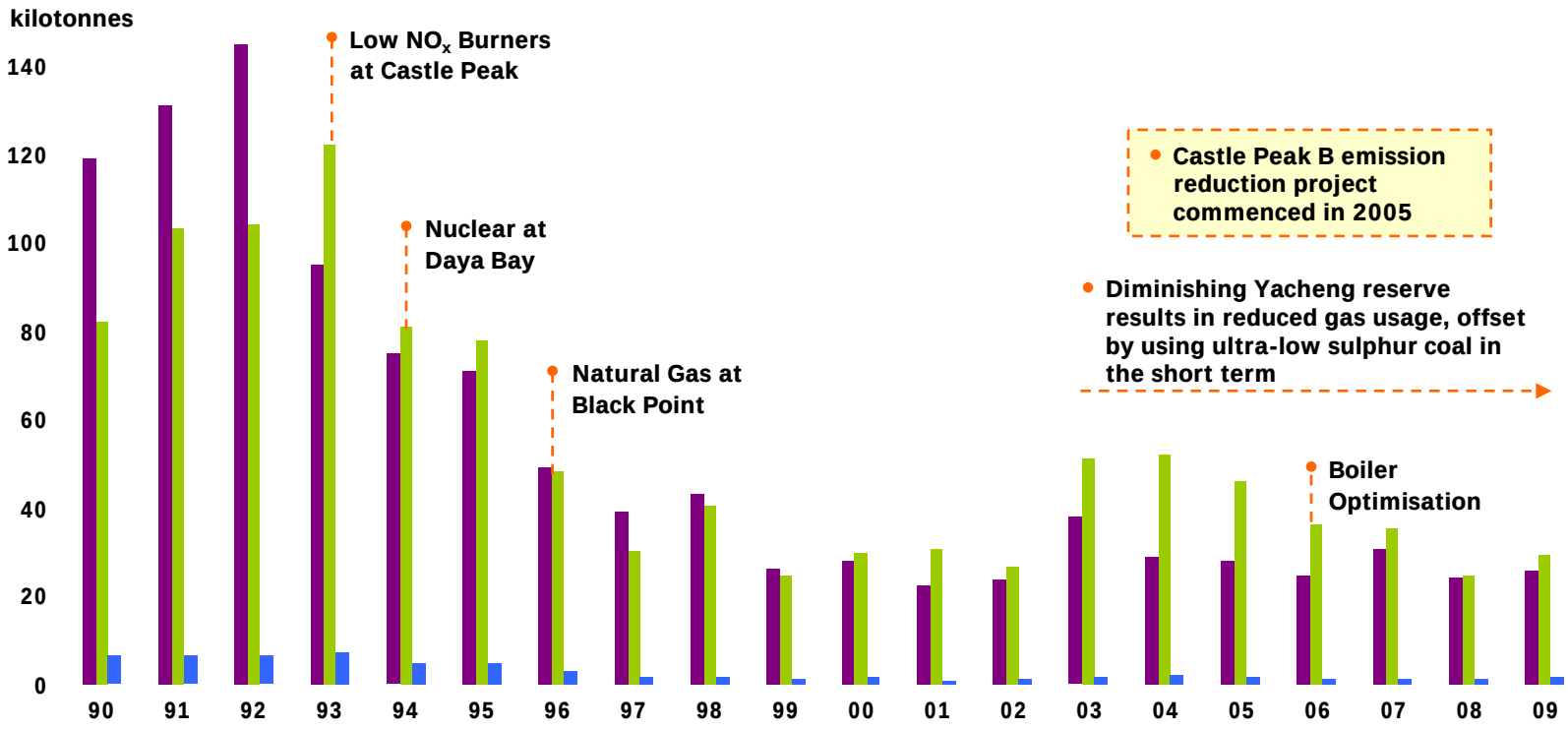
Particulates

Source: Report on the Mid-term Review of the Pearl River Delta Regional Air Quality Management Plan by Special Panel on PRD Air Quality Management and Monitoring

Reducing regional emissions requires collaboration across sectors throughout the Hong Kong and PRD the Economic Zone

CLP's Environmental Performance in Hong Kong

Total Air Emissions



Ongoing efforts to reduce total emissions from power generation activities by 60-80% despite 80% increase in electricity demand since 1990.

Holistic Energy Efficiency and Conservation Plan

Solely focusing on generation side is not enough…

… "It should come with greater efforts to promote energy efficiency on DEMAND SIDE"

Holistic Plan to promote Energy Efficiency and Conservation activities to meet different customers needs

Community

Business Customers

Public

Work together with Customers to reduce carbon emission

CLP's Green Platform

Energy Efficiency Exhibition Centre

Showcase state-of-the-art energy efficient technologies

Business Centres

Total energy solution for SME customers

E-newsletter

Sharing of latest energy efficient technologies and success cases

Eco Home

Specialty store for energy efficient appliances

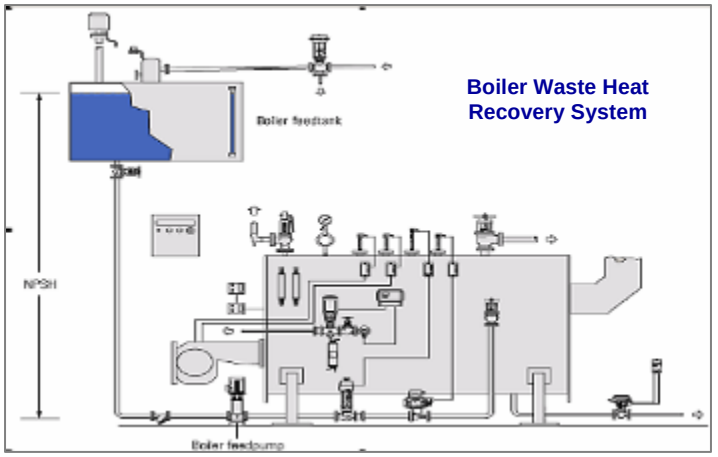
Green Studio

Educate the next generation on energy efficiency

Part II : CLP's Professional Energy Services

Energy Audit and System Design

Energy Audit



Energy Efficient System Design

Identify opportunities for energy efficiency enhancement through energy audit services which include

- ❑ Assessment and analysis of energy performance
- ❑ Identification of energy saving opportunities
- ❑ Potential saving estimation
- ❑ Tailor made recommendations

Through research and working with our vendors, we identify, source and develop energy-efficiency design in the areas of

- ❑ Hot water and steam production
- ❑ Electric cooking
- ❑ Lighting
- ❑ Demand control ventilation
- ❑ Dehumidification, etc.

System Implementation and China Business

System Implementation

Provide end-to-end solutions for system implementation which include:

- Electrical distribution systems
- Mechanical ventilation and air conditioning systems
- Hot water and boiler systems
- Energy management systems, etc

Energy Services in Peal River Delta

- Energy Services Company in Shenzhen to support CLP Climate Vision & improve the environment of Peal River Delta.
- A registered Environmental Technology service provider under the “Cleaner Production Partnership Scheme” from the Hong Kong Government & Hong Kong Productivity Council.

Meter Online Service

A simple and convenient means for our customers to access the most up-to-date load profile information on line.

Load Monitoring

Display of energy consumption and demand by months, by days, or by hours.

Benchmarking

Compare different accounts or same account over different periods

Proactive Energy Management

A function to watch out consumption peaks and give out alerts if energy consumption in the past 24 hours has reached pre-set limits.

Success Case 1 : Chiller Performance Analysis

A Shopping Centre

- Chiller consumed ~30% of the total consumption of a commercial building.
- Reviewed operation records
- Conducted site measurements of electricity consumption, temperatures and flow rates of chilled and condensed water
- Assessed the actual 'Coefficient of efficiency' (COP)
- Advised customers regarding chiller maintenance and replacement plan.

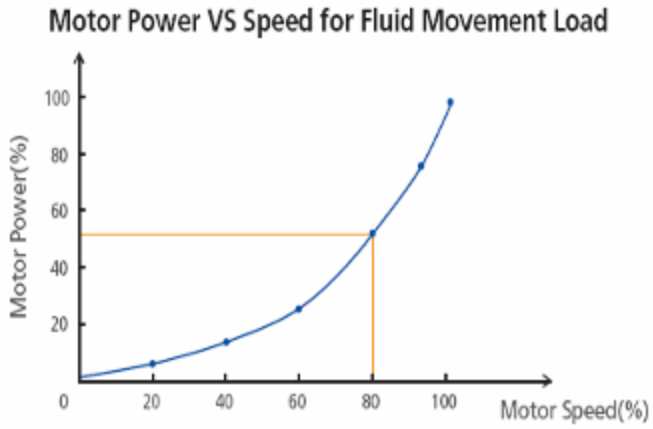
Example: 4 x 500 tons chillers

	Existing air-cooled chiller	New air-cooled chiller	New water-cooled chiller
COP	**2.3**	**3.2**	**5.2**
Estimated annual electricity consumption	**8.5GWh**	**5GWh**	**3.5GWh**

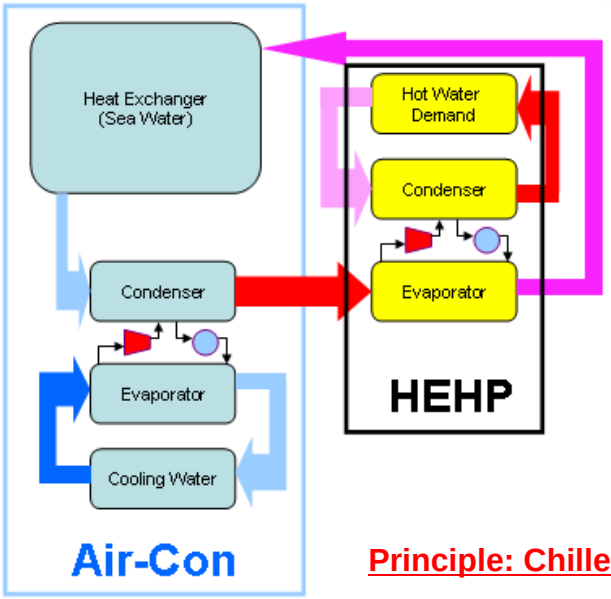
Success Case 2 : Variable Speed Drive

A Food Catering Company

- Ventilation fans used in centralized primary air handling units (PAUs) operated at constant speed
- The customer was recommended to install variable speed drive and CO_2 demand ventilation control system
- Motor power and power consumption reduced up to 50% by lowing 20% of motor speed
- 20% energy saving for the PAU system
- Payback period : ~2 years



Success Case 3 : High Efficiency Heat Pump (HEHP)



A 5-Star Hotel

- The hotel used 3 centralised diesel steam boilers for laundry, heating and hot water usage.
- The COP of conventional water sourced heat pump is ~3 in heating up water to 55°C. HEHP adopts high grade heat source – condensing water from chiller to increase the COP to > 4.5.
- Save ~60% energy costs and reduce flue gas emission.
- The payback period is about 3 years.

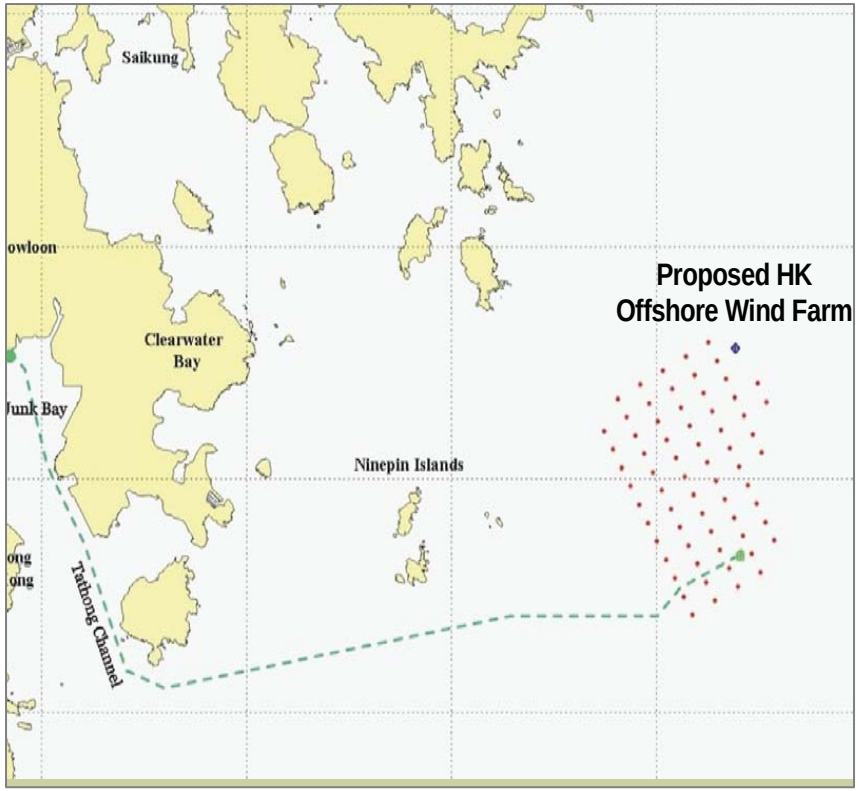
Principle: Chiller Condensing Water as Heat Source of HEHP

Part III : CLP's Renewable Initiatives

Renewable Electricity Generation (1/2)

Off-shore Wind Farm

- At approx. 10km east of the Clearwater Bay Peninsula
- Up to 200MW (i.e. ~1% of HKSAR's total power generation)
- Power nearly 80,000 households
- Offsets per year:
  - ~350,000 tons of CO_2
  - ~50 tons of SO_2
  - ~400 tons of NOx
  - ~15 tons of particulate material
- Expected to be commissioned in 2016



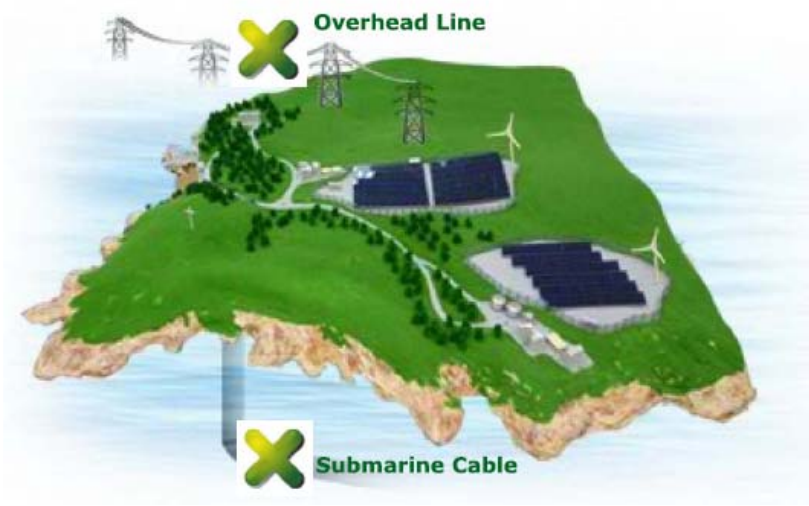
Viewing from Clearway Bay Country Park

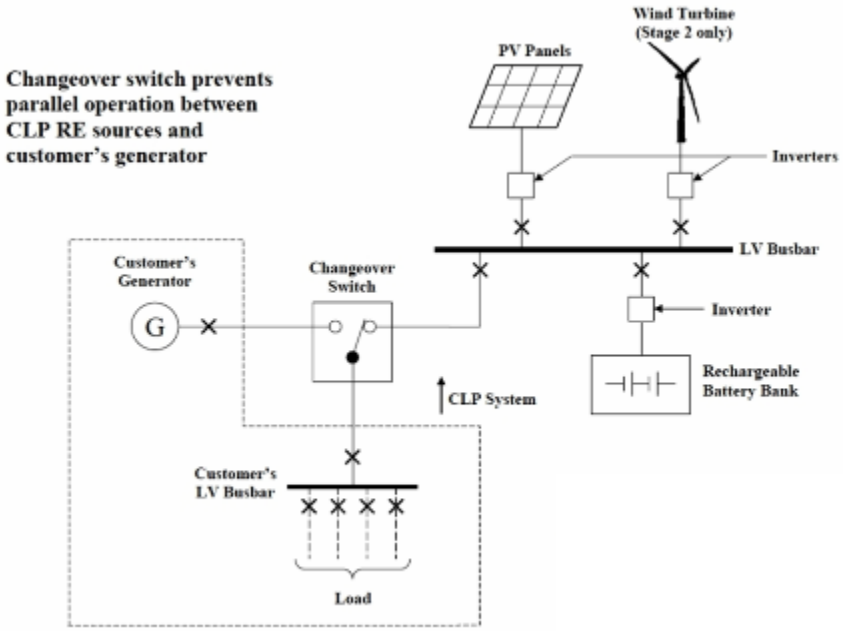
Source : www.epd.gov.hk

Renewable Electricity Generation (2/2)

Standalone Renewable Power System in Town Island

- Replace the three diesel generators with:
  - 900 solar panels (total 200kW)
  - two wind turbines (2 x 6kW)
- Cost 20% lower than submarine cable
- Avoid impact on scenery by overhead lines
- Expected to be commissioned in 2011





Renewable Projects with Customers (1/2)

Solar Thermal Water Pre-heating System at a University Resident Hall

- Professional service with total solution from design to commissioning
- 126 sets of solar heat pipes with total power rating of 1,600kW
- Largest project of this kind up to 2007
- Pre-heat fresh water for showering service for over 400 hostel space
- Estimated annual saving is about 88,000kWh

Renewable Projects with Customers (2/2)

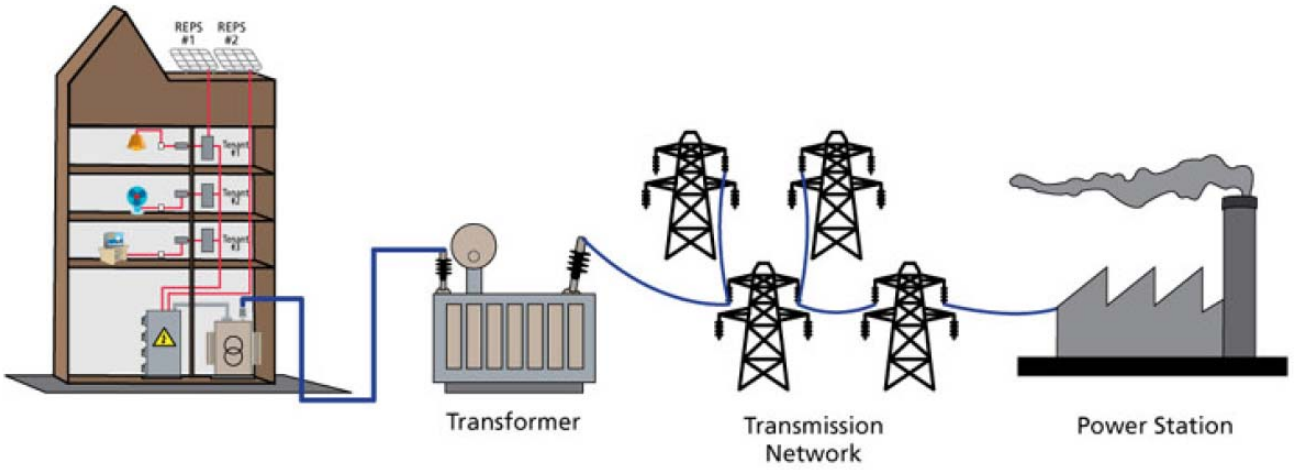
Solar BIPV for a Public Park

- Total solution from design to build
- 20 sets of semi-transparent glass panels with a total of 2.4kW design power output
- Generate about 2,400 kWh of electricity per year

Tips on Grid Connection (1/2)

CLP Support to Grid Connected Renewable Energy Power System (REPS)

- CLP provide technical advice to assist customers to connect their renewable energy system to CLP's power grid for backup supply
- Until 31 March 2010, 61 customer renewable energy installations have been connected to CLP's grid



Source : Technical Guidelines on Grid Connection of Renewable Energy Power Systems, EMSD

Tips on Grid Connection (2/2)

Process of Application to CLP for Grid Connected REPS

1. Applicant need to inform CLP at least 30 working days before start of project work
    - 10 working days for initial assessment
    - 20 working days for detailed technical assessment

2. Applicant need to provide an insurance policy to protect both parties from potential liabilities in case the REPS causes damage or injury to others

3. An assessment fee, calculated on the number of man-hours expended, will be charged for each successful application

4. Applicant need to arrange for CLP to witness commissioning test on system before connection to the electricity grid

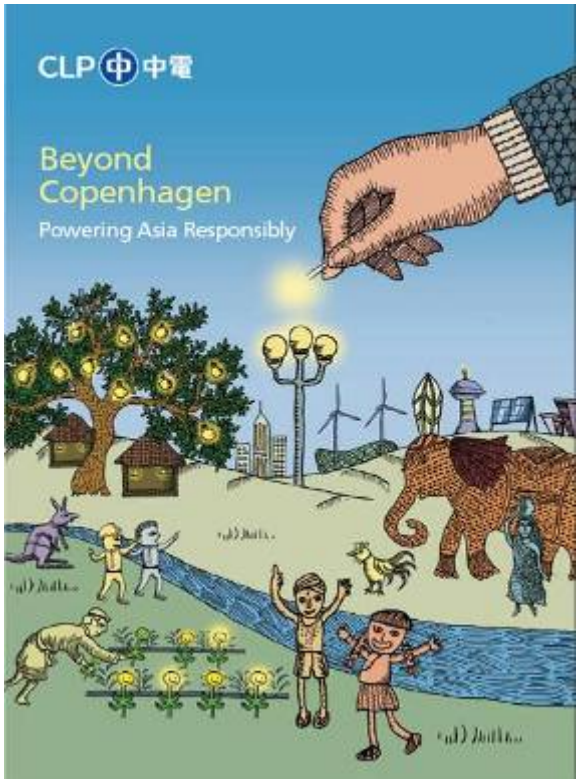
CLP is your EE&C partner, working together…

… we can build a GREENER future

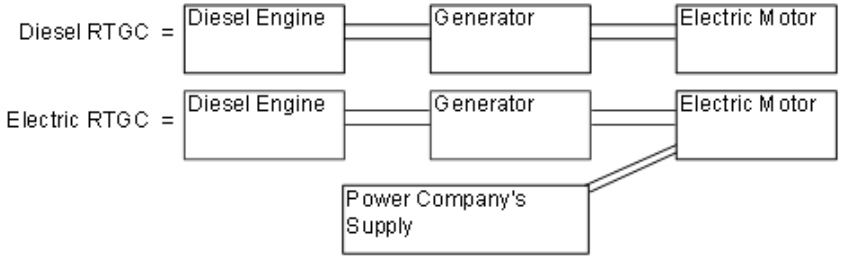
Thank You

Beyond Copenhagen – Powering Asia Responsibly

- Climate change manifesto titled **"Beyond Copenhagen – Powering Asia Responsibly"** issued in Nov 2009
- Two years ago, we set ambitious targets to mitigate the catastrophic risks of climate change by laying out a clear road map for the Group's climate strategy
- Currently, our non-carbon generation accounts for 15% of our total generation capacity.



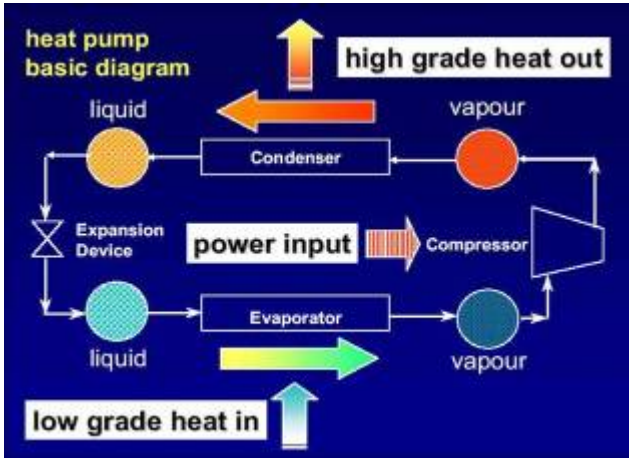
Success Case 4 : Rubber-Tyred Gantry Crane (RTGC)



A Container Terminal

- Diesel-run RTGCs emitted large volume of pollutants, even when they are idle
- CLP provided total solution to assist fuel switching of RTGC from diesel to electricity
- Significant effect on energy saving and emission reduction
  - ✓ Energy saving : 50-70%
  - ✓ Emission reduction (per RTGC):
  - ✓ 44% CO_2
  - ✓ 68% SO_2
  - ✓ 97% NO_x
  - ✓ 98% PM
  - ✓ Project payback period: ~ 3 years

Success Case 5 : High Temperature Heat Pump (HTHP)



A Laundry Workshop

- The workshop used diesel steam boilers for laundry process. Excessive waste heat was wasted.
- CLP advised the workshop to install a HTHP that adopted a newly invented environmental friendly refrigerant. Waste heat from the workshop could be recovered to improve the efficiency.
- HTHP produces hot water up to 90^{o}C for laundry process and steam boiler.
- The COP of HTHP is > 3 such that the operating expenses can be greatly reduced.
- ~50% energy saving achieved.
- The payback period of the project is around 2 years.

Other Renewable Projects with Customers

Support to Customer's Renewable Energy Power System (REPS)

- Management of the following solar PV technologies:
  a. Mono-crystalline silicon
  b. Poly-crystalline silicon
  c. Amorphous silicon
- Rated power of the solar PV panels is 40kW.
- Annual electricity generation is about 30,000 to 40,000 kWh.

- Design & commissioning of a solar PV system & a small wind turbine
- The solar system is rated at 2.4kW and grid-connected
- The wind turbine, rated at 600W, is a standalone system which provides electricity to a separate lighting system.

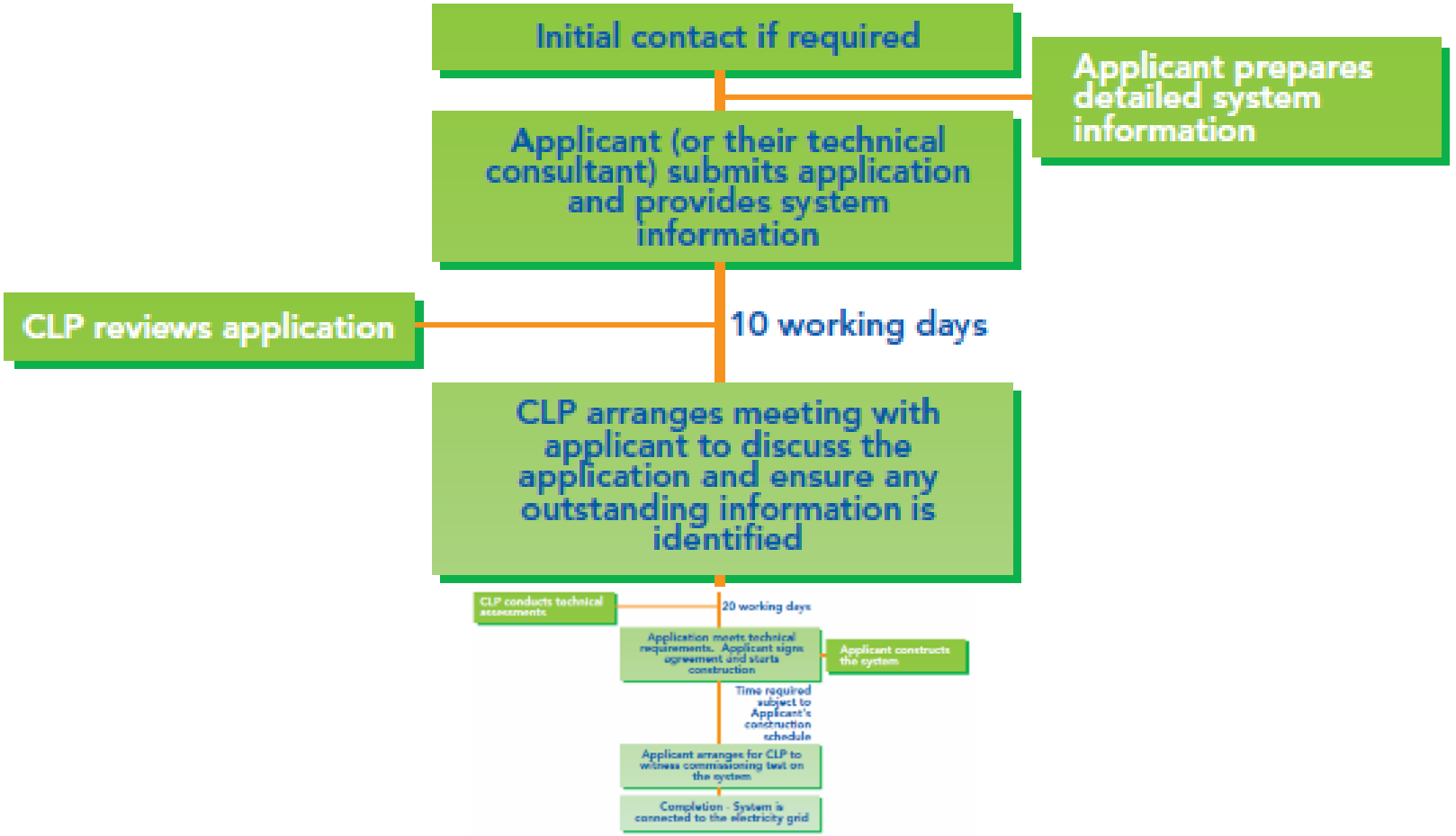
Tips on Grid Connection

Critical Functions for a Grid Connected REPS

- **Anti-islanding**, to automatically disconnect the grid connected REPS when the grid is de-energized due to whatever reasons
- **Synchronization-check**, to ensure grid connection will only take place when the differences in voltage magnitude, phase angle and frequency of the two power sources are controlled within acceptable limits
- **Protection of Unsynchronized Connection**, to protect REPS from damage by unsynchronized connection during rapid restoration of the grid by auto-reclosing operations after power failure
- **Power Conditioning Function**, to control the harmonic currents and the output power factor
- **4-pole** circuit breaker or isolator on all isolation points of the REPS

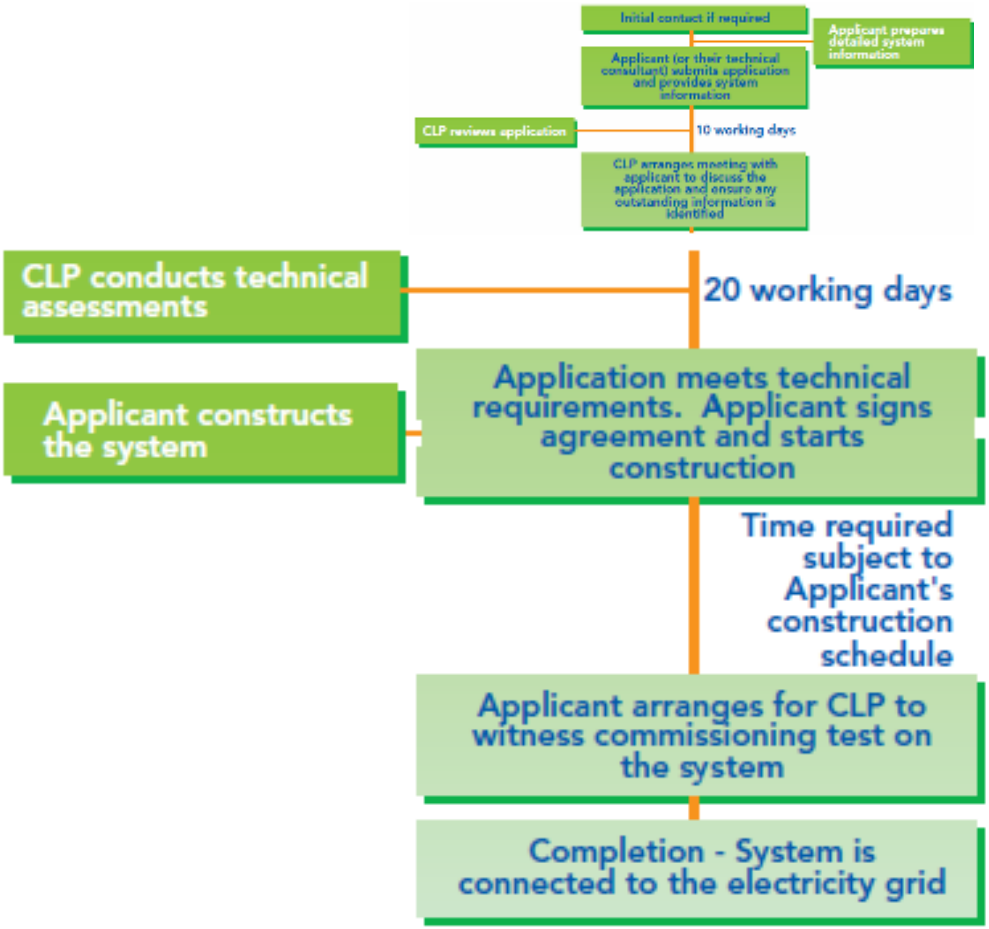
Tips on Grid Connection

Process of Application to CLP for Grid Connected REPS (1/2)



Tips on Grid Connection

Process of Application to CLP for Grid Connected REPS (2/2)



- **To make sure that all REPS connected to the grid could meet the technical and safety requirements**
- **An insurance policy to protect both parties from potential liabilities in case the REPS causes damage or injury to others will be provided by the applicant [CLP can arrange public liability insurance coverage for Schools and Non-profit Organizations]**
- **An assessment fee, calculated on the number of man-hours expended, will be charged for each successful application [CLP can waive the assessment fee for Schools and Non-profit Organizations]**