

CLP

More than light

# Greening in CLP Power HK Ltd's Transmission Substations

2 December 2010



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# 1. Transmission Substations

Transmission substation is one the key components in CLP Power HK Ltd's ( CLP) electrical power system. It controls the power flow in the transmission network and steps down the electricity voltage from transmission level ( 400kV and 132kV) to distribution level before feeding the 11kV consumer substations in its catchment areas.



Centenary S/S



Wan Po Road S/S

## **2. Roof Garden vs Sky Woodland**

**2.1 Common roof garden comprises shrubs, flower planters and lawn scattered on roof top**

**2.2 Sky woodland comprises trees which crowns interlocked with each others forming a natural canopy covering the entire roof of the building**

### 3. CLP's 1st Sky Woodland at Sham Mong Road S/S

#### 3.1 Objectives

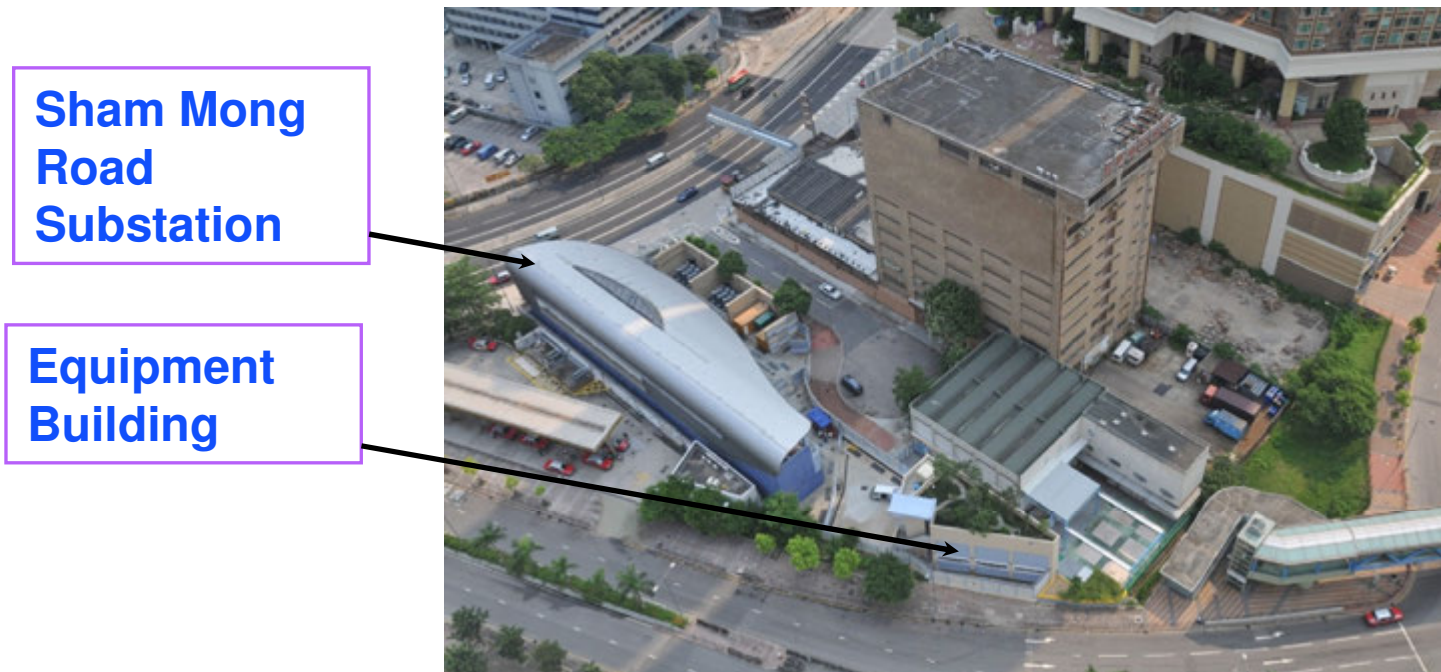
- **Pilot** for developing the first model of sky woodland in the highly urbanized environment of Hong Kong
- Enhance the environment of the local community
- Enhance public awareness of the sky woodland concept



## 3.2 Location

**3.2.1 The Sky Woodland is located on the roof (about 100 sq m) of an equipment building inside Sham Mong Road 132kV Substation at the western city skirt of Kowloon**

**3.2.2 This substation is located among many high-rise residential buildings with limited green areas**







## 3.3 Benefits

### 3.3.1 Environment

- Reduce indoor/outdoor temperature
- Reduce air pollutants in urban environment
- Improve landscaping, native ecology & biodiversity



*Elaeocarpus chinensis*

中華杜英

### 3.3.2 Energy Efficiency

Reduce solar heat absorbed by the building & save energy consumption on air -conditioning

### 3.3.3 Economy

Increase life span of the waterproof layer of the building roof (from 10 years to 20~30 years)

### 3.3.4 Continuous Improvement

Gain experience and data to facilitate future green roof developments



## 3.4 Project Programme

**Project Commencement – Jun 2006**

**Design Stage – Jun ~ Oct 2006**

**Plant Selection & Sourcing – Nov 2006 ~ Dec 2007**

**Civil Construction – Dec 2006 ~ Dec 2007**

**Soil & Hard Landscape – Jan ~ Feb 2008**

**Planting – Mar ~ May 2008**



*Ilex rotunda* 鐵冬青

## 3.5 Design of the Sky Woodland

### 3.5.1 Advisor: Professor CY Jim Chair Professor of Geog., HKU

### 3.5.2 Tree Patterns

- 1 m thick soil to allow healthy root development
- 12 heavy-standard trees (initially 3~4 m to ultimately 10 m tall)
- 6 small & medium-sized trees

Trees were planted closely to establish a crown interlocking effect and to emulate a natural woodland with a **continuous canopy**

### 3.5.3 Appearance



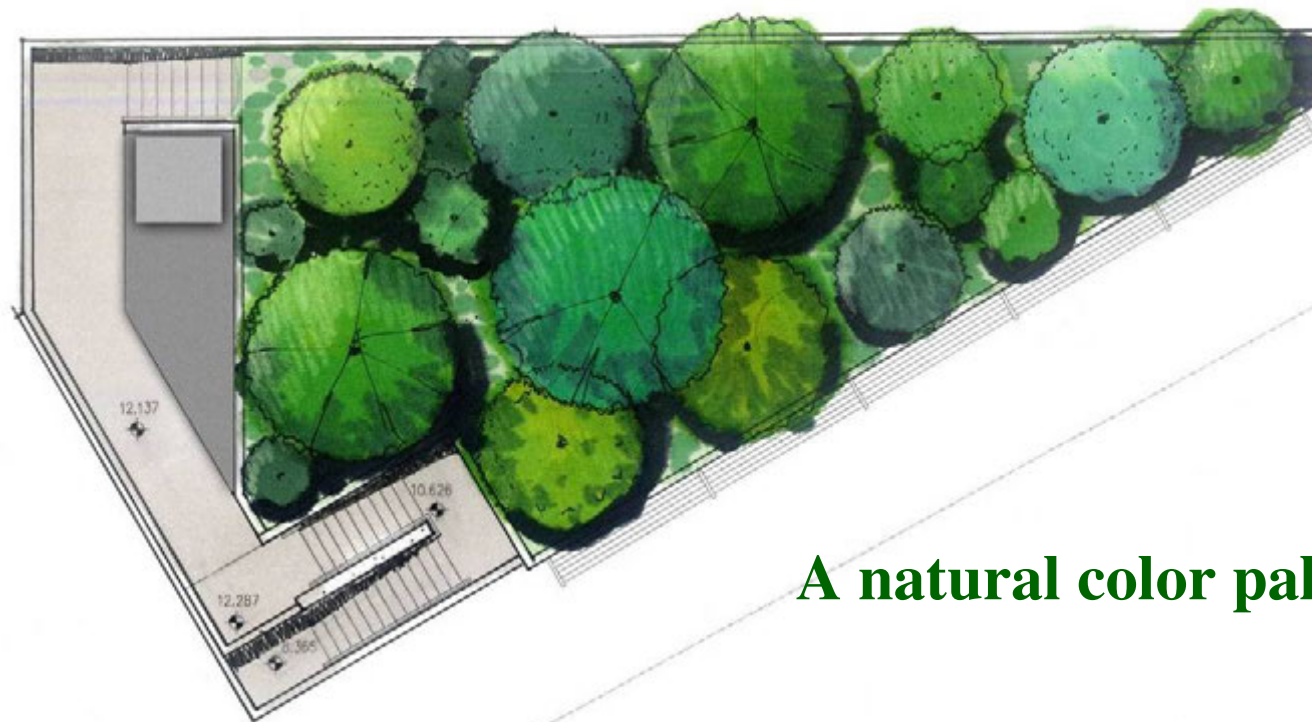
Initial Stage

### 3.5.3 Appearance



**Fully Grown Sky Woodland in Autumn in 3-4 years**

### 3.5.3 Appearance



**A natural color palette**

Roof Plan  
scale 1:75 (A3)

**Sky Woodland Plan View**



## 3.5.4 Selection of Trees & Herb

- Native tree species
- With special meaning to Hong Kong
- Low maintenance need
- Aggressive root avoided
- Slow growth rate & high wind resistance
- With seasonal variation
- Promote local ecology
- Special herb (which grows well in shaded environment) was used to cover up top soil to preserve water from loss via evaporation

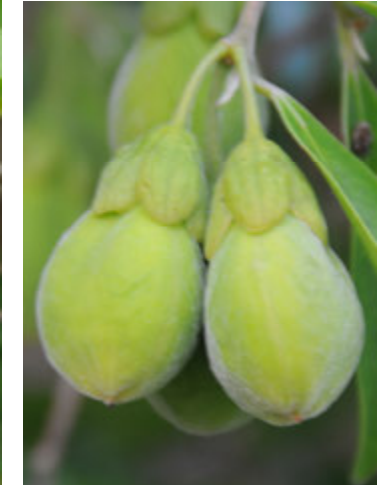
*Liriope spicata* Lour 麥門冬



### 3.5.5 Examples of Trees in Sky Woodland



Camellia semiserrata Chi 南山茶



Incense Tree 土沉香、牙香樹、白木香、香樹

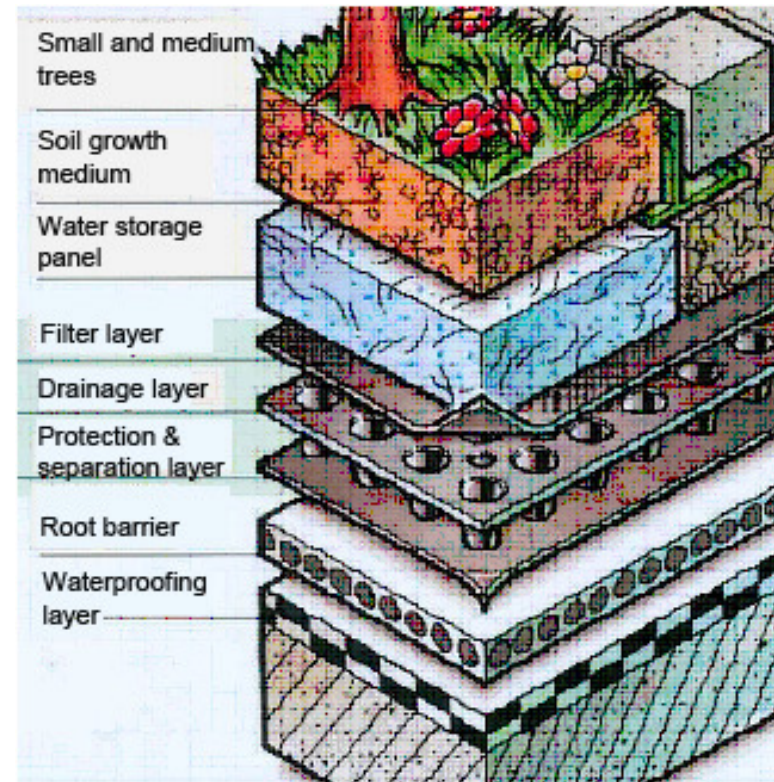


Lanceleaf Sterculia 七姐果，假蘋婆，紅郎傘



Callery Pear 麻子梨

## 3.5.6 Soil & Drainage



### Effective Drainage & Subsoil layer

- Anti-mosquito breeding
- Anti-flooding
- Protection of waterproofing & building structure



## 3.6 Construction



**Root Barrier**



**Water Storage Layer**

## 3.6 Construction



### Soil -filling





## 3.6 Construction

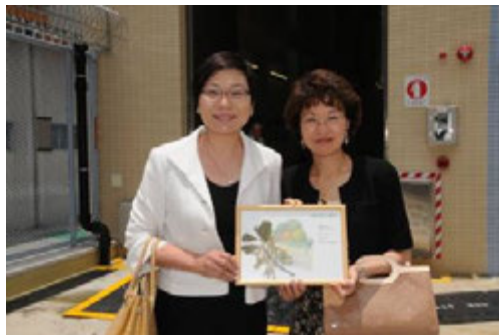


## Tree transplanting

## 3.7 Results

**3.7.1 The trees recovered promptly after transplanting, grew well and maintained in good shape after several typhoon strikes.**

**3.7.2 This ‘Live example’ successfully aroused public awareness & demonstrated the viability of applying Sky Woodland in the highly populated & sub-tropical urban environment of Hong Kong**



### 3.7.3 The Sky Woodland enhanced local ecology and bio-diversity



**Photos Taken at Sham Mong Road  
Sky Woodland on 17 Dec 08**



### **3.8 Challenges & Interesting Elements in Project Implementation & Initial Operation of the 1<sup>st</sup> Sky Woodland**

- **Lack of project reference for the first-of-its-kind project in HK**
- **Limited supply of mature native trees in HK**
- **Initial support of trees is crucial for resisting typhoon before their root systems can offer adequate support and their crowns have interlocked with each other against strong wind**
- **Intrusion of aggressive exotic species to the open design woodland**
- **Chinese herbal resources**

	樹木名稱	功能	病例
1	土沉香	降氣、暖胃、止痛	支氣管哮喘、月經不調
2	麥門冬	清熱、潤肺、養陰、生津	百日咳、肺結核咳嗽
3	厚皮香	清熱解毒、消癰腫	乳腺炎
4	陰香 (假玉桂)	祛風散寒、溫中止痛	寒性胃痛
5	假蘋婆	散瘀止痛	跌打損傷
6	女貞	種子:補腎滋陰、明目烏髮	頭髮早白
7	微果冬青	清熱解毒、消腫止痛	感冒、外用跌打損傷
8	烏柏	利尿、殺虫、解毒	水腫、血吸蟲病、傳染性肝炎
9	油茶	茶油:潤腸	腸梗阻、蛔蟲腹痛



## 4. Second CLP Sky Woodland

### 4.1 Chui Ling Road Substation (CLR) at TKO



## 4.2 Size of CLR Sky Woodland

- **Total area: 520 sq m on the roofs ( 380 & 140 sq m) of two buildings in the 132kV substation**
- **5 times of the pilot one at Sham Mong Road Substation**



## 4.3 Special features of CLR Sky Woodland

- 20 + small and medium native tree species
- Approx 60 – 70 heavy standard trees on 1 m deep soil. Mature height can reach 5 -10m
- Maintain two main design themes
  - \* Continuous Canopy
  - \* Natural Color Palette
- Top soil of the woodland will also be covered with *Liriope spicata* Lour or *Selaginella uncinata* for preserving water
- Vertical greening on external walls ( approx 500sq m)



翠雲草  
*Selaginella uncinata*



## 4.4 Examples of Potential Tree Species



假蘋婆  
*Sterculia lanceolata*



鐵冬青  
*Ilex rotunda*



山蒼樹  
*Litsea cubeba*



香花枇杷  
*Eriobotrya fragrans*



土沉香  
*Aquilaria sinensis*



白桂木  
*Artocarpus hypargyreus*



石筆木  
*Pyrenaria spectabilis*



厚皮香  
*Ternstroemia gymnanthera*



## 4.4 Examples of Potential Tree Species



葛量洪茶  
*Camellia granthamiana*



香港茶  
*Camellia hongkonensis*



油茶  
*Camellia oleifera*



紅苞木  
*Rhodoleis championii*



洋紫荆  
*Bauhinia blakeana*



嶺南槭  
*Acer tutcheri*



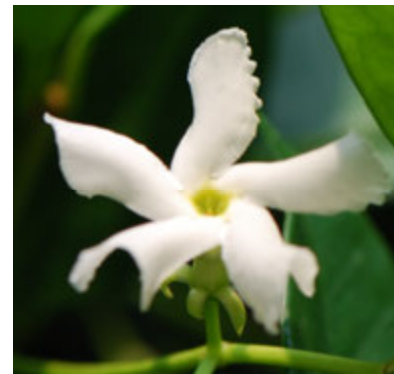
## 4.5 Examples of Potential Climbers



穿根藤  
*Psychotria serpens*



薜荔  
*Ficus pumila*



絡石  
*Trachelospermum  
jasminoides*



炮仗花  
*Pyrostegia venusta*

## 4.6 Key Milestones of CLR Sky Woodland

- **Project commencement : Dec 2010**
- **Design and sourcing of appropriate trees : Jan 2011**
- **Completion of civil work: Dec 2012**
- **Transplanting : Apr 2013**
- **Completion: Jun 2013**



## 5. Ways Forward

- **Actively explore the viability of applying green roofs at appropriate sites**
- **Carry out greening initiatives at various existing substations including vertical greening at Lai Chi Kok 400kV, New Hoi Shing Road and San Shek Wan Substations, etc.**



**Thank you**



## Sham Mong Road Sky Woodland in Aug 2008

