

Table 1: Notable examples of EPC projects

Building name (data source)	Location	Building completion date	EPC Project cost (US\$)	Estimated annual energy savings (US\$)	Estimated annual energy saving %	Payback (years)	Key Measures
The Empire State Building (The U.S. Department of Energy, 2011)	New York, the United States	1931	\$13.2M	\$4.4M (total)	38%	3	<ul style="list-style-type: none"> • Upgrade window efficiency • Install radiative barriers • Lighting upgrades • Implement tenant energy management
TAIPEI 101(Siemens, 2013a)	Taipei, Taiwan	2004	N/A	\$2 M (total)	10%	N/A	<ul style="list-style-type: none"> • Lighting upgrades • Utilize Energy Management and Control Systems (EMCS) • Use low-flow water fixtures
Singapore Post Centre (Singapore Post, 2008)	Singapore	2000	\$1.5 M	\$0.947 M (total)	23%	1.8	<ul style="list-style-type: none"> • Upgrade chilled water plant
Federation Square (Siemens, 2013b)	Melbourne, Australia	2002	N/A	\$ 0.829 per year	40%	N/A	<ul style="list-style-type: none"> • Install combined heat and power plant and photovoltaic system, and a biogas plant • Upgrade chilled water plant
The Pamela Youde Nethersole Eastern Hospital (Gilleard and Wan Yeung, 2008)	Hong Kong	1993	\$3.4M	\$0.22M (total)	5.6%	5	<ul style="list-style-type: none"> • Lighting upgrades • Chiller plant modification • BMS control strategy modification

Table 2: Comparison of policy incentive to the use of EPC between Hong Kong and Taiwan

	Hong Kong	Taiwan	Remark
Target on energy/CO ₂ reduction	The Hong Kong government has committed to reduce the carbon intensity level by 50-60% by 2020 as compared with 2005	Energy efficiency is increased by at least 2% a year during the next eight years so that energy intensity in 2015 will be reduced by at least 20% when compared to the baseline level of 2005	N/A
Pilot EPC Projects	Several pilot EPC projects in public buildings, including police stations, hospitals and a game hall*	The government launched “the Promotion on the Use of Energy Performance Contracting Subsidy Scheme” whereby the eligible public parties can apply for implementing the pilot project	In the case of Hong Kong, these pilot projects are not typical EPC projects. The upfront capitals were arranged by the government, instead of ESCOs. Instead, the government looked for the guarantee savings.
Standard form of EPC contract	N/A	Model Contract for Guaranteed Energy Performance Package Deal Projects	In Hong Kong, several attempts were made to incorporate the term of energy saving guarantee into “the General Conditions of Contract for E & M Engineering Works”
M&V guideline	N/A	M&V guidelines suitable for the local weather and practices were developed by the Taiwan Green Productivity Foundation	N/A
Financing incentive scheme	N/A	The Preferential Loans for Service Industry Development*	In Taiwan, the provision of loans is funded either jointly by the CEPD (the National Development Fund) and the participating bank in a ratio of 1:1 or by the bank alone using its own capital, and in case of repayment default by ESCOs during the contract period, the Small & Medium Business Credit Guarantee Fund may cover the losses up to 80 percent of the loan made by banks
Establishment of ESCO association	The Hong Kong Association of Energy Service Companies (HAESCO)	1) The Taiwan Association of Energy Service Companies (TAESCO) 2) The Taiwan Energy Service Association (TESA)	N/A
ESCO accreditation scheme	N/A	N/A	In both Hong Kong and Taiwan, ESCOs generally welcome an accreditation scheme.
Training courses for M&V expertise	N/A	Regular training courses are provided by the Taiwan Green Productivity Foundation (TGPF), but the certification is accredited by the government	N/A
Seminars	Yes*	Yes*	*Various seminars were aimed at promoting the awareness and understanding of EPC projects among the stakeholders

Table 3: Profiles of the ESCO questionnaire respondents in Hong Kong and Taiwan

Category	Hong Kong			Taiwan		
	Freq.*	Per.*	Cum. Per.*	Freq.	Per.	Cum. Per.
Work Experience						
Below 5 year	4	12.1	12.1	11	35.5	35.5
6 – 10 years	3	9.1	21.2	3	9.7	45.2
11 – 15 years	1	3.0	24.2	5	16.1	61.3
16 – 20 years	4	12.1	36.4	1	3.2	64.5
Over 20 years	21	63.6	100.0	11	35.5	100.0
Years of the respondent's department						
Below 5 year	8	24.2	24.2	3	9.4	9.4
6 – 10 years	7	21.2	45.5	4	12.5	21.9
11 – 15 years	1	3.0	48.5	4	12.5	34.4
16 – 20 years	4	12.1	60.6	5	15.6	50.0
Over 20 years	13	39.4	100.0	16	50.0	100.0
Staff number						
Below 25 staff	10	30.3	30.3	15	50.0	50.0
26 – 50 staff	7	21.2	51.5	5	16.7	66.7
51 – 100 staff	5	15.2	66.7	4	13.3	80.0
Over 150 staff	11	33.3	100.0	6	20.0	100.0

*Freq. = frequency; Per. = percent; Cum. Per. = cumulative percent

Table 4: Profile of Interviewees

ID	Sector	Position of Interviewee	Nature of organisation	Location
1	Private	Chairman	An association of energy services companies	Hong Kong
2	Public	Senior consultant	A trade council	Hong Kong
3	Private	Director	An ESCO	Hong Kong
4	Public	Retired chief engineer	The Electrical and Mechanical Services Department	Hong Kong
5	Private	General manager	A building owner	Hong Kong
6	Private	Vice president	A bank	Hong Kong
7	Private	Chairman	An association of energy services companies	Taiwan
8	Public	Facility manager	A tertiary institution	Taiwan
9	Public	Former chairman of a works committee	A tertiary institution	Taiwan
10	Private	Project manager	An ESCO	Taiwan
11	Private	Loan manager	A bank	Taiwan

Table 5: Results of Cronbach's Alpha Test

Section in questionnaire	Cronbach's Alpha	
	Hong Kong	Taiwan
Potential building retrofit work	0.790	0.681
Motivation of building owners towards the use of EPC	0.849	0.931
Reasons for building owners not considering EPC	0.674	0.724

Table 6: Results of Kendall's W and Chi-Square test

	Potential of building energy retrofit work		Motivation of building owners towards the use of EPC		Reasons for building owners not considering EPC	
	HK	TW	HK	TW	HK	TW
N	23	22	28	27	31	29
Kendall's W	0.263	0.300	0.076	0.128	0.181	0.157
Chi-square	72.68	79.16	21.23	34.52	44.77	36.31
Degree of freedom	12	12	10	10	8	8
Chi-square critical value (at 5%)	21.03	21.03	18.31	18.31	15.51	15.51
Asymptotic significance	<0.001	<0.001	0.02	<0.001	<0.001	<0.001
H ₀	R	R	R	R	R	R

H₀ = respondents' rankings are independent of each other within each group

Reject H₀ if the actual chi-square value is larger than the critical value of chi-square

Table 7: Mean score and rankings of the potential building retrofit work

Potential energy retrofitting works		HK				TW			
		N	Mean	Rank	SD	N	Mean	Rank	SD
1	Lighting replacement to more efficient fluorescent lamps(e.g. replace T8 with T5)	32	4.09	1	0.96	30	4.20	1	0.89
2	Lighting replacement to LED lamps	32	3.75	3	0.84	30	3.70	3	1.12
3	Lighting replacement (replacing incandescent light bulbs with compact fluorescent lamps)	32	3.50	6	1.05	30	2.87	10	1.31
4	Installation of time switches and sensors	32	3.53	5	0.98	27	3.33	6	1.00
5	Replacement of power switch gear at control room	30	2.63	11	1.13	28	3.25	7	1.11
6	Improvement of existing air-conditioning system (other than cleaning)	31	3.81	2	.95	27	3.63	4	1.15
7	Replacement of air-conditioning system from air to water cooling	30	3.73	4	.91	28	2.64	12	1.22
8	Works involving heat pumps (machines capable of both heating and cooling)	29	3.34	7	.97	28	4.04	2	1.23
9	Change of energy source from gas to electric	30	3.13	9	1.14	24	2.79	11	1.22
10	Change of energy source from electric to gas	28	2.39	13	1.07	23	1.87	13	.69
11	Use of renewable energy (e.g. solar and biofuel)	31	3.00	10	1.29	28	3.07	8	1.39
12	Lift & escalator improvement (change of motors, excluding interior decoration)	28	3.14	8	1.04	27	3.37	5	1.21
13	Building fabric improvement (e.g., insulation, double window, etc.)	29	2.41	12	1.24	28	2.96	9	1.40

Table 8: Mean score and rankings of the EPC motivation

Motivation of Building Owners towards use of EPC, if they would consider it		HK				TW			
		N	Mean	Rank	SD	N	Mean	Rank	SD
1	Lack of capital to implement energy saving measures on their own	33	3.91	1	0.84	29	3.97	3	1.02
2	Provision of turnkey services as all-in-one package including energy audit, retrofit and financing	32	3.75	2	0.84	28	4.21	1	0.92
3	Use of energy saving for other purposes may yield better return	31	3.65	3	0.88	29	3.83	4	1.04
4	A quick way to comply with legislation requirements	33	3.58	5	0.79	29	3.21	11	1.15
5	Transfer the technical/performance risk from clients to ESCOs	31	3.26	11	0.97	29	4.00	2	0.76
6	Reliance on ESCOs' expertise	31	3.39	8	0.76	29	3.66	7	0.67
7	ESCOs provide staff training for better system operation and control	30	3.30	9	0.92	29	3.34	10	0.86
8	Budgeting of energy consumption taken care of by ESCOs	31	3.48	7	0.81	29	3.59	8	0.98
9	Expect higher energy efficiency than design-bid-build	32	3.50	6	0.95	28	3.79	5	1.19
10	More comfortable environment after installation or upgrading	29	3.59	4	0.83	29	3.76	6	1.02
11	EPC is a cost effective solution to achieve energy saving	33	3.30	10	0.92	29	3.41	9	1.13

Table 9: Mean score and rankings of the reasons for building owners not considering EPC

Likely reasons for Building Owners NOT considering EPC		HK				TW			
		N	Mean	Rank	SD	N	Mean	Rank	SD
1	Lack of familiarity with EPC	33	4.09	2	0.88	30	4.03	2	0.96
2	Worry about its complexities (e.g. procedures, legal issues)	33	4.27	1	0.80	30	4.33	1	0.80
3	Not convinced that EPC can achieve higher saving than design-bid-build	32	3.41	7	0.80	30	3.57	6	1.01
4	Worry about measurement & verification inaccuracies (assuming no fraud)	33	3.55	5	0.83	31	3.71	4	.97
5	Not convinced that it is cost effective	33	3.36	8	0.96	31	3.29	9	1.01
6	Worry about disruption to their normal business operation or use of property	33	3.48	6	1.00	30	3.40	7	0.86
7	Worry about ESCOs' guaranteed saving not being achieved, causing problem to 3 rd party financing	33	3.58	4	0.83	31	3.58	5	1.06
8	Worry about integrity of ESCOs	32	3.34	9	0.87	31	3.32	8	1.01
9	Long payback period	33	3.91	3	1.01	30	3.87	3	1.07

Table 10: Results of the Mann-Whitney U test

Section ID	Section in questionnaire	Respondents from Hong Kong vs Taiwan (Asymp. Sig<0.05)
Potential energy retrofitting works in Hong Kong		
7	Replacement of air-conditioning system from air to water cooling	0.00051
8	Works involving heat pumps (machines capable of both heating and cooling)	0.0109
Motivation of Building Owners towards use of EPC, if they would consider it		
2	Provision of turnkey services as all-in-one package including energy audit, retrofit and financing	0.026
5	Transfer the technical/performance risk from clients to ESCOs	0.00186