Detailed Analysis of the ESCO Market in Japan: Based on JAESCO Survey

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ABSTRACT

It has been 7 years since ESCO businesses in Japan started in 1996. Currently, with 24 ESCOs working, the market volume of performance contracts has reached $117 million, and has doubled every year. The ESCO market is growing rapidly, but in a different way than the market in the U.S.A.

Key features of the ESCO market in Japan are the following: (1) Most ESCOs are departments or subsidiaries of large companies; (2) private sector buildings hold the major market share; (3) especially in 2002, the industrial sector market expanded suddenly; and (4) shared savings contracts hold more than one-half of the market. These features indicate that the Japanese market is still developing.

The ESCO business is expected to reduce energy use by 1 million kL oil-equivalent in 2010 under the policy of global climate change mitigation measures. Accordingly, the government has set forth various policies to promote ESCO business.

The Japan Association of Energy Service Companies, which leads ESCO business promotion in Japan, conducted a detailed survey of actual results of ESCO projects over the past two years. In this paper, we describe the detailed analysis of the survey results and the features of ESCO business in Japan, such as type and size of buildings, project cost, contract type, rate of energy savings, guaranteed rate of energy savings, cost reduction, simple payback period, contract years, and the energy-efficiency measures introduced, based on 356 projects which include 124 projects with performance contracts.

Introduction

In June 2002, the Government of Japan ratified the Kyoto Protocol. With the US having rejected the Kyoto Protocol, trends in Russia in large part hold the key, but ratification by Japan is of major significance in making the Kyoto Protocol go into effect. In order to achieve the greenhouse gas emission reductions pledged in the Kyoto Protocol, the Government of Japan has adopted various mitigation measures. In particular, as designated in the outline of the New Climate Change Policy Program, 2004 is the critical year in which attainment during Step 1 (2002 to 2004) is reviewed, and planning for Step 2 (2005 to 2007) is adjusted accordingly.

In Japan, ESCO (Energy Service Company) business has drawn attention as a new business model that allows realization of energy-efficiency projects in existing buildings and in small and medium-size factories, facilities in which there is a great potential for energy-efficiency gains, but where projects have been difficult to implement. There are also great expectations for ESCO business as a climate change mitigation measure.

ESCO business in Japan was planned with reference to the ESCO business model in the USA. Therefore, the way of thinking about ESCO business in Japan is the same as that of traditional ESCO business in the USA. However, utility restructuring in Japan has happened in a limited way so energy service businesses have not developed as diversely as in the USA. In other words, an ESCO in Japan differs from the usual energy conservation consultant with activities

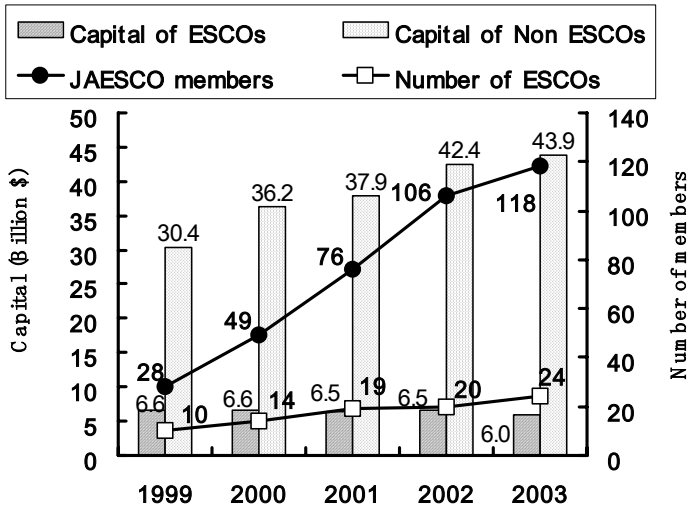
such as development, sales, planning and installation of energy efficient equipment. Our ESCOs offer comprehensively everything related to improving energy efficiency, including financing. They are energy efficiency improvement businesses that cover the cost of energy efficiency improvements with the savings from decreased operating costs and use performance contracts that guarantee a certain level of efficiency improvement.

Market Size of the ESCO Industry

Japan first took up the issue of ESCO business in 1996, when the Ministry of Economics, Trade and Industry (METI) set up the ESCO Study Committee. This committee was charged with using ESCO business in the USA as a model and studying measures to adapt it to Japan. Since 1997 the Energy Conservation Center Japan (ECCJ) has annually convened a committee studying measures to adapt the ESCO business to Japan, analyzing the effectiveness of demonstration projects, and studying measurement and verification (M&V) protocols. Since 1997, the number of private sector corporations launching ESCO businesses has grown. Including self-proclaimed ESCOs, there are now about 60 ESCOs, but the number of ESCOs with actual experience in performance contracting is smaller. In 1999, there were 10 ESCOs with experience and in early 2004 there were 24 such ESCOs. We expect this number to grow in the future, along with the expansion of the ESCO market.

In October 1999, the Japan Association of Energy Service Companies (JAESCO) was formed, and all the main ESCOs in Japan participated in its planning. Its mission is to foster the healthy development and spread of the ESCO business in Japan. The number of members has grown quickly, from the 16 founding member companies, to 118 members (or 123, if special members are included) in August 2003 (Figure 1).

Figure 1. Number and Capital of JAESCO Members and Member ESCOs

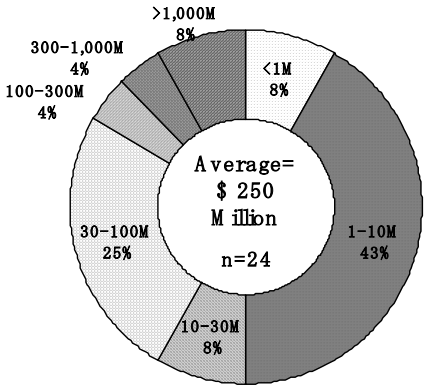


Source: JAESCO, personal communication, August 2003

The average capital of the 24 ESCOs is $250 million (Figure 2). Small and medium-sized businesses with capital of $10 million or less make up 50% of the ESCOs, but 58% of those companies are subsidiaries of large corporations. However, approximately 70% of the ESCOs in

Japan are participants from large corporations. In contrast, most ESCOs in the USA are small or medium-sized businesses.

Figure 2. Capital of ESCOs JAESCO Members



Source: JAESCO, personal communication, 8/2003

JAESCO carried out a survey of the market sizes of its members, which include ESCOs by E-Mail. The energy-efficiency retrofit market of its members expanded from $131 million in 1998 to $374 million in 2001 and $429 million in 2002. Of course, these values are only for member ESCOs, and the overall market in Japan has probably grown several times larger. Of the total energy-efficiency retrofit market, the market size of the ESCO business (i.e., energy-efficiency retrofits carried out via performance contracts with guaranteed energy savings) grew by a factor of 14 from $7.6 million in 1999 to $117 million in 2002. The percentage of the overall energy-efficiency retrofit market held by ESCO business is 27% but the market size of ESCO businesses is doubling annually.

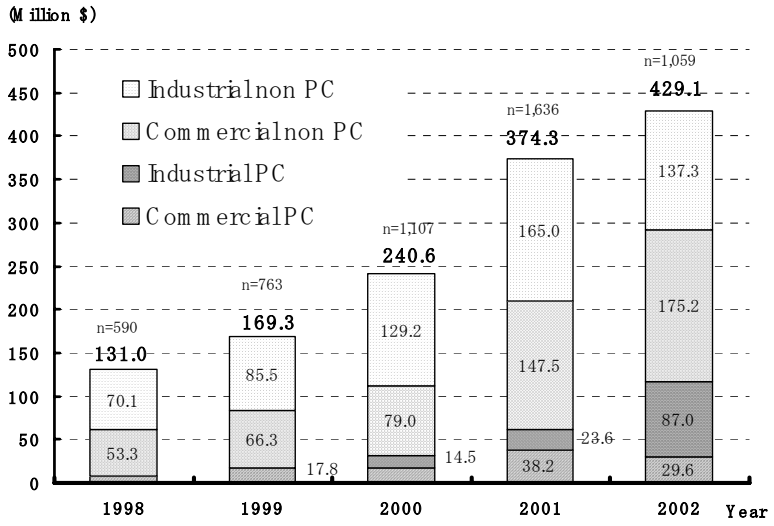
In 2002, the overall energy-efficiency retrofit market was split roughly evenly between the industrial sector, at $224 million, and the commercial sector, at $205 million. However, for ESCO businesses with performance contracts, the industrial sector, at $87 million, held 3/4 of market share, while the commercial sector was $30 million. This is a reversal of the situation in 2001, when the industrial sector held only 38% of market share and the commercial sector was more popular. This reversal is due to the sudden expansion of the industrial market.

Examining 2002 ESCO businesses by type of contract, overall, 80% were shared savings contracts (SSCs) (Figure 3 and Tables 1 and 2). For the commercial sector, guaranteed savings contracts (GSCs) and SSCs each held about half the market share. In contrast, for the industrial sector, 90% were SSCs. SSCs in the industrial sector accounted for 68% of all ESCO business contracts.

Examining 2002 ESCO businesses per project, the industrial sector had larger scale projects, with an average of $1,474,000, compared to $348,000 for the commercial sector. In 2001, the industrial sector project average was $462,000. There has been a major increase in project scale, but it is difficult to discern trends using only the 2002 results. In the commercial sector, we can see a trend toward project sizes increasing yearly, with averages of $136,000 in 2000 and $223,000 in 2001. By contract type in 2002, SSC average project size was $1,736,000. In particular, while industrial sector SSCs had a large average size of $3,033,000, GSCs had a relatively small average size of $254,000 and were about the same size in both industrial and commercial sectors.

The ESCO business has matured into a $117 million market. Although difficult to judge simply based on results from 2002, a shift toward the industrial sector and a trend toward large-scale projects can be seen.

Figure 3. Change in Energy-Efficiency Retrofits and ESCO Market Size Over Time
JAESCO Members



Source: JAESCO, personal communication, 9/2003
PC = Performance Contracting

Table 1. Percentage of Shared Savings Contracts (%)

Year	1999	2000	2001	2002
Commercial Sector	4.9	12.1	41.3	50.3
Industrial Sector	44.7	26.2	58.4	90.6
Average	5.8	18.5	47.7	80.4
number of sample	n=122	n=143	n=225	n=144

Table 2. Investment Per Project ($ 1,000/project)

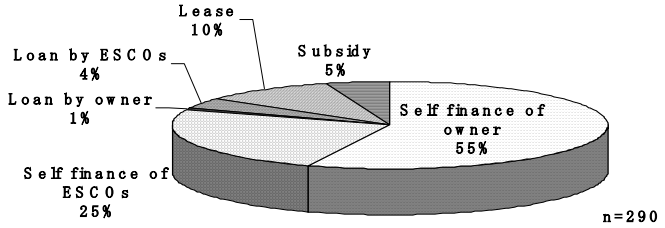
Year		1998	1999	2000	2001	2002
Commercial Sector	GSCs	151	140	121	153	258
	SSCs	--	845	1,068	676	531
Industrial Sector	GSCs	12	53	1,191	211	247
	SSCs	--	173	1,270	1,109	3,033
Total	GSCs	141	137	190	166	254
	SSCs	--	509	1,189	824	1,736
number of sample		N=54	n=122	n=143	n=225	n=144

Regarding the industrial sector ESCO market, many corporations have in-house engineering groups, so it was not expected that the industrial sector market would grow as much as it has. On the other hand, the Energy Conservation Law (ECL) stipulates that large factories must improve energy efficiency by 1% annually. The ECL regulations have encouraged factories to improve energy efficiency. At the same time, as awareness of the ESCO industry has gradually

increased, the ECL has become an incentive for factory managers to outsource energy-efficiency retrofits. Also, because large-scale factories have high credit ratings and can sell bonds to finance their own projects, it becomes simple for ESCOs to offer SSCs. We expect these are the reasons that large-scale projects, including cogeneration, could be carried out.

The source of funds for energy-efficiency retrofit projects is shown in Figure 4. Very little funding is obtained from loans. Eighty percent of funds are self-financed, 5% by loans from financial institutions, and 10% by leases. From these results, we understand that the corporations undertaking energy-efficiency retrofits are nearly all "blue chip" enterprises in good standing that can afford the investments, or corporations with high credit ratings, making it easy for ESCOs to obtain financing themselves.

Figure 4. Source of Funds for Energy-Efficiency Retrofit Projects

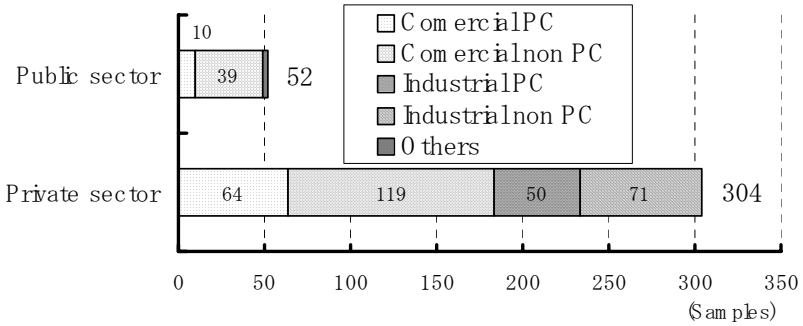


Source: JAESCO, personal communication, August 2003

Detailed Survey Results of ESCO Projects

JAESCO carried out a detailed survey of its members regarding the content of their 2001 and 2002 energy-efficiency retrofit projects. Total number which provided by JAESCO members are 1,695 projects in 2001 and 2002. And we collected the data of 365 samples by the detailed survey. The breakdown of these 356 projects is shown in Figure 5. Public sector projects made up 14.6%, private sector industrial projects 51.4%, and commercial projects 34.0%. Performance contracts made up 34.8% of the whole, with 20.8% commercial and 14.0% industrial.

Figure 5. Sample Size for JAESCO Survey



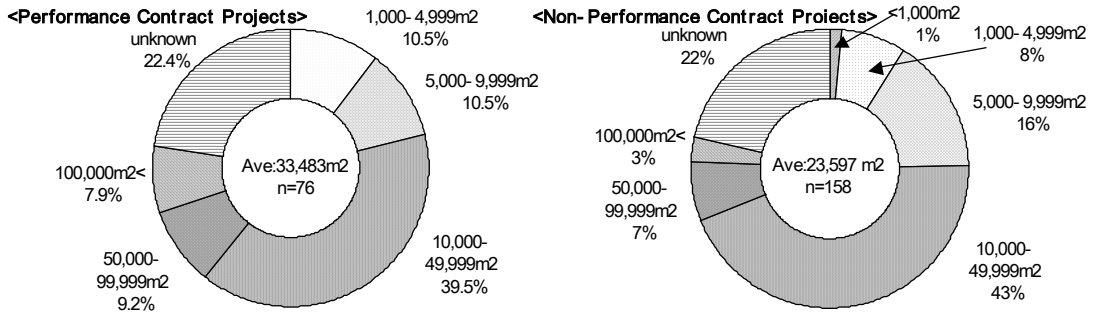
PC = Performance Contracting

Central and local government facilities are thought to be the largest future market for ESCO business. But market development has hardly succeeded because, there are various procedural issues remain unsolved. But, activities of local authorities for ESCO projects are growing year by year.

The average floor area of commercial facilities with performance contract projects (PCPs) was 33,500 m2, while that of non-PCPs was 23,600 m2 (Figure 6). PCPs covered a larger floor area, but for both contract types 40% of the projects were for buildings with floor areas between 10,000 and 50,000 m2.

The breakdown of average floor area among facility types for PCPs was as follows. Hospitals (74,700 m2), hotels (58,600 m2), and commercial facilities (40,500 m2) exceeded the commercial sector average. Offices (22,700 m2) and schools (10,000 m2) had lower floor areas.

Figure 6. Distribution of Floor Area in Commercial Facilities



The average investment per project in the commercial sector was $615,000 for PCPs and $439,000 for non-PCPs (Table 3). PCPs were somewhat larger scale, and among these, SSCs were the largest. For factories the average investment per project was $2.2 million for PCPs and $336,000 for non-PCPs. PCPs averaged 6.5 times higher than non-PCPs. SSCs were very large-scale projects, averaging $2.3 million.

Table 3. Project Scale ($1,000/project)

			Average	Max	Min	S/D	n=
commercial sector	PC Ave		615	5,455	13	1,120	66
		GSC	492	--	--	--	24
		SSC	747	--	--	--	42
	non PC		439	5,905	6	971	146
industrial sector	PC Ave		2,171	8,333	22	2,628	38
		GSC	851	--	--	--	3
		SSC	2,284	--	--		38
	non PC		336	4,545	5	843	57

The rate of energy savings, which represent savings as a percent of whole facility's energy use, is shown in Figure 7. For commercial sector projects, the rate was 11.1% for PCPs and 12.2% for non-PCPs. SSCs had a higher rate of savings, at 12.2%, than GSCs, at 9.3%. Comparing the rate of savings for different types of commercial sector facilities (Figure 8), offices at 13.2%, and

hotels at 12.3%, exceeded the average, while schools, at 11.0%, and commercial buildings, at 10.2%, were lower.

The economics of PCPs are studied more critically than those of non-PCPs, so it is more difficult to include energy-efficiency measures with long payback periods in PCPs. That probably accounts for the lower rate of energy savings for PCPs than for non-PCPs. We can see similar trends in simple payback period (SPP) and length of contract (Fig. 9 and Fig. 10). For the commercial sector, PCPs had a shorter average SPP of 7 years, compared to 8.3 years for non-PCPs. Among PCPs, GSCs were shorter, with 3.9 years, compared to 8.9 years for SSCs. Similarly, the average contract period was shorter for GSCs, at 4.4 years, compared to 10 years for SSCs.

Figure 7. Rates of Energy Savings

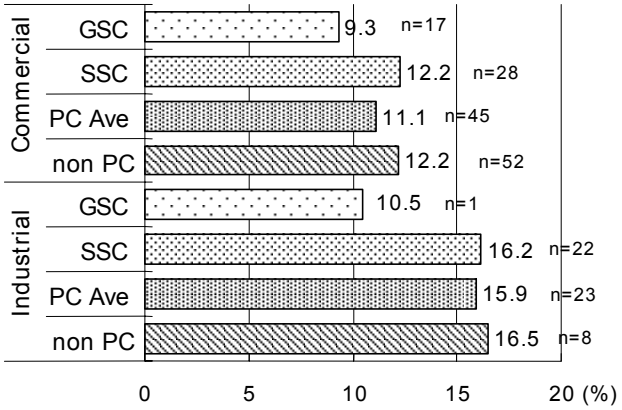
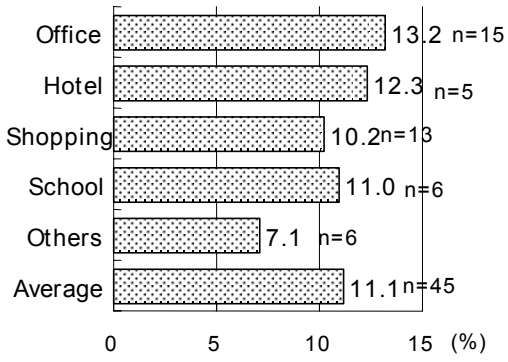


Figure 8. Rates of Energy Savings for PCPs by Facility Type



The difference in contract period and SPP between GSCs and SSCs is due to SSCs posing a smaller risk to the owner than GSCs, so that a measure with a long payback period becomes easy to implement. In particular, many ESCOs in Japan are large corporations that can easily attract capital, so a trend is seen even in the case of SSCs to pursue higher energy saving results.

Factories generally had higher rates of energy savings and longer SPPs than commercial facilities. The average energy savings rate for PCPs was 15.9% and for non-PCPs was 16.5%, not a big difference. Also, nearly all contracts were SSCs, with almost no GSCs, which is characteristic of this sector. The average SPP for factory projects exceeded the average contract period, but it is difficult to do a simple comparison due to variations in sample size.

The average investment per unit of conserved energy is shown in Figure 11. Factories were more cost-effective (4.7 cent/MJ/year) than commercial facilities (8.1 cent/MJ/year). That factories, with their longer average SPP, were more cost-effective for saving energy than commercial facilities, may be due to lower energy prices for factories. Comparing PCPs to non-PCPs, PCPs were more cost-effective. In particular, for factories PCPs had a higher cost-effectiveness, at 4.6 cent/MJ/year, than non-PCPs, at 8.6 cent/MJ/year. In this case, assuming energy prices are essentially the same for both contract types, there is a disparity between the relation of SPP and cost-effectiveness. We believe this disparity arises from statistical error due to some subject ESCOs restricting their cost-effectiveness data.

Figure 9. Simple Pay-Back Period

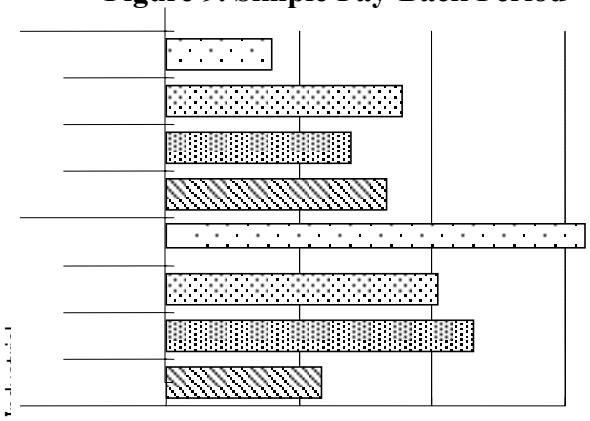


Figure 10. PCPs Contract Period

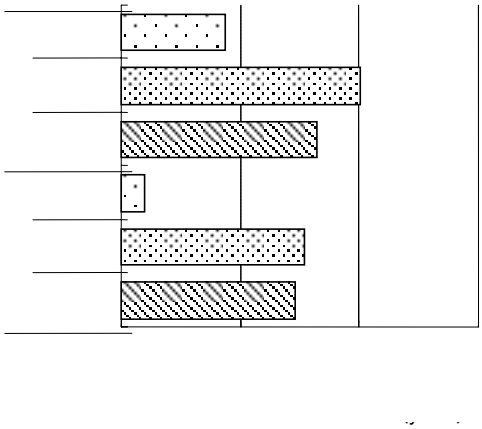


Figure 11. Cost-Effectiveness of Investment in Energy-Efficiency Projects

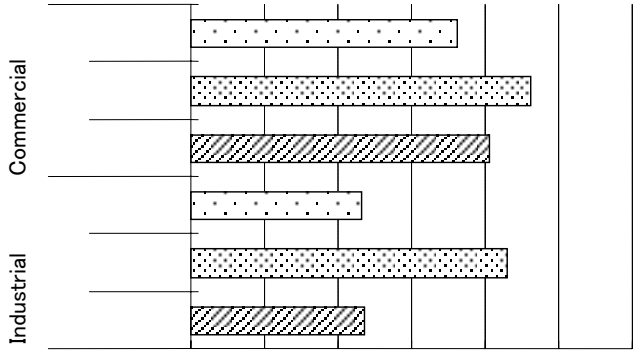


Table.4 shows energy-efficiency measures (EEMs) used in industrial and commercial sector projects. For industrial sector, frequently used EEMs included variable-speed, electronic pumps and fans (40.0%), cogeneration (30.0%), changes to production process (18.0%), and high-frequency electronic lighting (10.0%). For commercial sector, frequently used EEMs included variable-speed, electronic pumps and fans (46.1%), high-frequency electronic lighting (27.6%), controller by CO2 sensor (23.7%), use of outdoor air for ventilation (14.5%), demand control (14.5%), and building energy management systems (BEMS) (11.8%).

Table 4. Energy Efficiency Measures for PCPs (%)

		industrial sector	commercial sector
Air Conditioner	Pump/Fan INV	40.0	46.1
	VAV,VWV	2.0	3.9
	Open air-AC	--	5.3
	Control open air load	--	14.5
	All heat exchange	2.0	--
	Controller by CO2 sensor	6.0	23.7
	Intermittent control	--	2.6
Boiler & Freezer	Cogeneration	30.0	3.9
	Renewal of boiler	8.0	--
	Renewal of freezer	8.0	5.3
	On/Off control	4.0	3.9
Lighting	HF Inv	10.0	27.6
	Compact lamp	--	5.3
	HID lamp	2.0	1.3
	Occupancy censor	--	3.9
	Illumination censor	--	2.6
	Inv lighting	--	2.6
	Other lighting	--	10.5
Electric power	High efficiency transformer	--	6.6
	High efficiency motor	4.0	1.3
Control	BEMS	2.0	11.8
	Demand control	--	14.5
Water conservation		--	9.1
Production process		18.0	--
number of sample		n=50	n=76

Government Policies to Encourage ESCO Business

METI has carried out various support measures to encourage the ESCO industry. The central support measure is subsidies for energy-efficiency retrofit projects. The amount of subsidies paid is approaching $200 million. The rate of subsidy applicable is 1/3 of the total project cost for private sector facilities and 1/2 for local authority facilities. Each year, the subsidies have expanded and have served to increase awareness and credibility of the ESCO industry. Also, the subsidy system has become easier to use to obtain funds. For example, when a corporation wants to procure ESCO business it receives bids from ESCOs, and the project content is decided based on the proposals received. The subsidy application takes place after the project content is decided, so when the application is made, ESCO bidding is complete. In contrast, for general subsidy programs, bidding for projects must occur after the subsidy has been awarded, preventing access to general subsidies for ESCO business. Furthermore, because the application period for subsidies is usually April, the problem has arisen of regional public sector groups developing their requests for ESCO business proposals between January and March. To solve these problems, the government has responded by revising part of its subsidy system. Revisions include recognizing that ESCO bidding takes place prior to the subsidy application process, and also dividing the subsidy application period in two, one in spring and one in fall.

The various subsidy programs for energy-efficiency retrofits are listed below (with the subsidy percentage after the amount).

1. project to introduce equipment with rational use of energy ($125.5 million: 1/3)
2. project to introduce and promote high energy-efficient systems in residence and buildings ($19.1 million: 1/3)
3. local energy-saving diffusion-and-promotion project ($25.5 million: 1/2)
4. spread of building energy management systems ($32.7 million: 1/3)
5. local energy-saving planning ($4.5 million: 100%)

The first three programs are subsidies for energy-efficiency retrofit projects or procurement of high-efficiency equipment. There is not a large difference between programs 1 and 2, but 2 seeks a higher rate of energy savings. Because the target for program 3 is local authorities, the higher subsidy rate of 1/2 applies. Program 4 is specific to the introduction of BEMS. Program 5 subsidizes the cost of local authorities developing plans to promote energy efficiency, to perform studies that are precursors to introducing ESCO business. Using this subsidy, local authorities decide on facilities to target for ESCO business, analyze energy savings expected, and estimate project costs.

In April 2003 the Energy Conservation Law (ECL) was revised. Until then regulations regarding energy management had applied only to large factories. Now these regulations also apply to large commercial facilities. Standards for large factories and businesses target facilities using more than 3000 kL/year or 12 million kWh/year as Type 1 energy management facilities, and they are requested to improve energy efficiency by 1% annually. The standards also target facilities using more than 1500 kL/year or 6 million kWh/year as Type 2 energy management facilities, and they are requested to report their energy consumption. Type 1 energy management facility standards had mainly applied to factories, but in the 2003 ECL revision all large-scale facilities are targeted. The 2003 ECL revision features are listed below.

- Inclusion of large-scale commercial buildings as targets of regulation
- Addition of regulations for air conditioning equipment
- Addition of regulations for use of BEMS
- Strengthening of application to tenant buildings
- Addition of regulations for installation of cogeneration
- Addition of regulations for electrical generating equipment
- Addition of encouragement for the practical use of ESCOs

The 2003 ECL revision has great significance for ESCO business. Type 1 energy management facilities are required to prepare plans to implement energy-efficiency improvements and improve energy efficiency by 1% annually. Also, installation of BEMS is indicated under standards for introduction of high-efficiency equipment, and it is suggested that the necessary studies be subcontracted to ESCOs.

In 2002, industrial sector ESCO business increased suddenly, and the ECL regulations applicable to industry help explain the increase. Pursuant to the revised ECL, regulations previously applying only to the industrial sector are now extended to large-scale commercial facilities. In particular, from 2004 on, the government will carry out on-site inspections of

large-scale commercial facilities to evaluate the implementation of the ECL. It is expected that commercial sector ESCO business will grow from now on due to this strengthening of regulations.

At present, there has been no introduction of ESCO business at facilities of the central government. However, METI has included funds for introduction of ESCO business in its 2004 budget. Also, the National Institute for Environmental Studies is studying the introduction of ESCO business. These central government facilities plan to implement ESCO projects in 2004.

Future Prospects

Future prospects for energy-efficiency retrofits as a whole look good, with continued expansion expected. When compared to the previous year, the forecasted growth rate is 82% for FY 2003 and 127% for FY 2004. The outlook for ESCO projects is unknown because such a survey has not been done, but these are expected to show expanded growth, even exceeding the growth rate of energy-efficiency retrofits as a whole.. Regarding trends for large-scale industrial shared savings contract projects, it is possible that big fluctuations will occur in the short term. However, as the importance of global climate change mitigation measures is further recognized with planning for the end of Phase I in 2004 and the beginning of Phase 2 in 2005 of the New Climate Change Policy Program, the encouragement of energy-efficiency policies for the industrial and commercial sectors seen in the revised ECL is expected to allow for great advances in future ESCO business.

Conclusion

ESCOs in Japan are characteristically large corporations or their subsidiaries, and the objects of ESCO business up to now have mainly been "blue chip" companies in good standing. These characteristics have made it simple for ESCOs to finance projects using shared savings contracts.

The average rate of energy savings is not particularly high, at 11% for commercial facilities and 16% for industrial facilities. However, the average simple payback period for performance contract projects is long, at 7 years for commercial facilities and 11.6 years for industrial facilities.

The ESCO market in Japan is $117 million, but it is doubling annually. It is expected that future market expansion will contribute significantly as a global climate change countermeasure. To implement such countermeasures, besides revising the Energy Conservation Law, the government is also strengthening its support for ESCO business. Simultaneously, recognition of ESCO business has gradually increased, and the ESCO market in Japan is poised to increase significantly.

Notes

1. Conversions from yen to dollars were taken as 130 yen/$ in 1998, 110 yen/$ in 1999 and 2000, 120 yen/$ in 2001 and 2002, and 110 yen/$ in 2003.
2. All dollar displays are nominal values.

Acknowledgement

We thank Barbara Litt for her help translating this paper into English.

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