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UNLOCKING ENERGY PERFORMANCE CONTRACTING IN INDIA

Issue Brief

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EXECUTIVE SUMMARY

As India pursues ambitious plans for sustainable development and equitable growth, energy efficiency is emerging as an important low-cost and available technology resource. Both new and existing buildings provide opportunities to implement energy- and cost-saving measures in the building sector. However, the market for building efficiency remains relatively small.

To grow the market, the Indian Ministry of Power's Bureau of Energy Efficiency (BEE) has prioritized development of energy efficiency services for India's public and commercial sectors. Energy performance contracting (EPC) is a proven, scalable, and internationally recognized procurement method for reducing the operating costs and environmental impacts of buildings at low risk to property owners. EPCs are a core business offering of energy service companies (ESCOs), which provide turnkey responsibility for retrofits and take on the performance risk of the project (e.g., ensuring that projected energy savings materialize). Despite government support for the EPC process, the Indian ESCO industry remains immature compared to other emerging economies that are also engaging ESCOs to grow the building efficiency market.

The paper explores the opportunity for scaling investment in building efficiency as a means to reach India's sustainable development goals, the barriers that must be addressed to capitalize on the opportunity, and contracting methods that can expand the deployment of energy efficiency.

We put forward three recommendations for growing the Indian ESCO industry:

1. Establishing a policy framework for EPC and a Standard Design-Build Procurement Process to expand beyond the country's Energy Efficiency Services Limited (EESL) program.
2. Expanding training and assistance to agencies and building owners on tools and approaches.
3. Stimulating third-party financing.

The recommendations draw on the successful development of the U.S. and Canadian ESCO markets, and while the specifics may therefore need to be modified for local conditions, the models are useful for discussion and study. The recommendations do not provide a prescriptive path to ESCO market development. Rather, they provide a starting point for further exploration.

CONTEXT: MEETING INDIA'S GROWING DEVELOPMENT AND ENERGY NEEDS WITH EFFICIENT, CLEAN SOLUTIONS

India is one of the world's largest economies with current gross domestic product (GDP) over $1 trillion (Rs. 45.3 lakh crore) and expectations of growth between 7 and 8 percent a year for the next two decades. GDP is anticipated to be $4.5 trillion (Rs. 204.2 lakh crore) by 2020.[2] India's economic growth will be accompanied by rapid urbanization – about 40 percent of the population is projected to live in cities by 2030. With urbanization and development come projections that consumer purchasing will increase by a 9 percent combined annual growth rate (CAGR) in cities and 5 percent in rural areas from 2005 to 2025.[3]

India's strong economic growth is likely to create corresponding increases in greenhouse gas emissions, water scarcity and other constraints on natural resources. In addition, India is expected to be at the front line of climate change impacts as floods and droughts become more frequent and dangerous. Yields

[1] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute.

[2] Edelweiss Capital (2010) "India 2020: Seeing, Beyond."

[3] McKinsey & Company (2009) "Environmental and Energy Sustainability: An Approach for India."

for most crops are expected to decline.[4] To meet the needs of its growing population and urban communities, India is pursuing ambitious plans for sustainable development and inclusive growth (see Table 1).

Access to energy is a fundamental building block of economic development, and the Government of India has paid particular attention to its energy and resource development. The International Energy Agency (IEA) predicts India's primary energy demand will more than double by 2030. One indicator of the electricity system's need for expansion is seen in current power shortfalls: peak load shortfalls in power generation are currently 12 to 15 percent. Power quality and supply are both major constraints to growth. (See Table 2). Yet the electric power supply of choice in India, as in many other countries, continues to be coal-based generation – with significant air, health, and climate impacts.

- Reduce the proportion of people living below the poverty line from nearly 37.5 percent in 1990 to 18.75 percent or less by 2015.
- Halve the proportion of population without access to safe drinking water and sanitation by 2015.
  - India has the lowest sanitation coverage in the world; about half the population – and up to 66 percent in rural areas – lacks access to toilets.
  - 33 percent of rural Indians lack access to clean water in their homes.

Table 1: Government of India Development Goals

- Reduce greenhouse gas (GHG) emissions intensity by 20 to 25 percent below 2005 levels by 2020 (emissions per unit of GDP).
- Meet 10 percent of the nation's energy needs with renewable energy sources by 2015.
- Develop 20,000 MW of solar power capacity across the country by 2022 (National Action Plan on Climate Change (NAPCC).
- Avoid 20 GWof electricity generation capacity over the next four years and save 100 million tons of greenhouse gas emissions annually through energy efficiency (The Indian Ministry of Power).

Table 2: Government of India's Energy Goals

As part of the UN Framework Convention on Climate Change (UNFCCC), nations around the world have pledged domestic actions to reduce greenhouse gas emissions in line with their efforts to create sustainable, equitable, and low-carbon development plans. The decarbonization of India's economy is challenged by the needs for new and additional power generation and smarter, more efficient use of energy. Achievement of these goals is further complicated by the structure of India's economy, which is largely cash-based and is challenged by high interest rates that may make it more difficult to finance energy projects and demand-side measures[5] (see Table 3).

While much of the energy and development agenda

- Cash-based economy: Almost one-third of economic activity is on a cash basis and is not accounted for in India's real GDP growth
- High cost of borrowing: prime lending rate to industry is roughly 11 to 12 percent (2010)

Table 3: Investment Trends in India

[4] India Climate Portal. Available at http://www.indiaclimateportal.org/how-climate-change-affects-india

[5] Kerala Investor (2010) "Needs of a Cash Based Economy." Available at: http://www.keralainvestor.com/visitor-blog/

in India has focused on creating additional energy supply, an important dialogue is also emerging on energy efficiency, led by the Indian Ministry of Power's Bureau of Energy Efficiency.

OPPORTUNITY IN BUILDING EFFICIENCY

Inefficiencies in India's building stock offer a considerable opportunity to further the country's environmental, economic and security goals. Energy efficiency improvements reduce energy and water use, cut pollutant emissions, reduce operating costs, improve the quality of indoor environments, and contribute to high-quality economic growth. Energy efficiency is a widely recognized, cost-effective approach to meeting energy demand because the savings from efficiency improvements pay back the initial investments in a relatively short time. Efficiency is the lowest-cost strategy to improve energy security and can reduce the overall societal cost of decarbonizing the energy supply, because renewable energy and other clean energy technologies are often more expensive than efficiency measures. The Intergovernmental Panel on Climate Change (IPCC) Fourth Report also reiterates the energy savings potential of the building sector as compared to all sectors – this is consistent across all countries and at all cost levels.

As a result of India's economic growth, the shift from rural to urban living, construction growth and human development, energy consumption in Indian buildings is expected to increase substantially. With a nearly 8 percent rise in annual energy consumption in the residential and commercial sectors, energy demand in buildings has seen an increase from 14 percent in the 1970s to nearly 33 percent in 2004-05.[6] The gross built-up area added to commercial and residential spaces was about 40.8 million square meters in 2004-2005, about 1 percent of annual average constructed floor area around the world, and the trends show a sustained growth of 10 percent over the coming years.[7] Thus, India must plan and implement energy efficiency measures as quickly as possible to avoid energy demand and carbon "lock-in" during this dynamic growth period.

In addition to the significant growth in building stock, the energy intensity of commercial buildings and households will increase as more buildings are air-conditioned and electrified, and as more consumers start using more appliances.[8] Most private sector office buildings in India have an energy performance index (EPI) of 200 to 300 kWh/m^2/year, versus 150kWh/m^2/year for similar buildings in North America and Europe.[9] Energy savings potential in the range of 23 to 46 percent has been identified through energy audits conducted in public buildings.[10] Even as policy makers and developers begin to incorporate efficient design into new construction, existing buildings remain great candidates for deep and comprehensive retrofits. It is also significant that heating and cooling for India's buildings comes primarily through electricity, while other countries use mainly oil, gas and coal for heating. This means saving on heating and cooling will lessen the need to build expensive power plants.[11] The World Resources Institute (WRI) estimates that aggregate investment potential for energy savings in Indian buildings alone amounts to $9.8 billion (Rs. 44,500 crore), including savings of 183.5 billion kWh and 148.6 million tons of CO_2 equivalent emissions.[12]

McKinsey's analysis of India's GHG abatement cost curve identifies 340 million tons CO_2 equivalent of avoided emissions and more than 30 percent electricity demand reduction through energy efficiency in buildings, appliances and lighting.[13] The study also ranks multi-sector energy-efficiency programs first in a 10-point agenda for reaching the overall abatement case potential.

[6] TERI (2010) "High Performance Commercial Buildings in India." Available at http://high-performancebuildings.org/pdf/HighPerformance Commercial%20Buildings.pdf.

[7] TERI (2010) "High Performance Commercial Buildings in India." Available at http://high-performancebuildings.org/pdf/HighPerformance Commercial%20Buildings.pdf.

[8] McKinsey & Company (2009) "Environmental and Energy Sustainability: An Approach for India."

[9] Mathur, A. (2007) "Energy Efficiency in Buildings in India: An Overview." Bureau of Energy Efficiency. Available at: http://www.sciencerepository.org/in_documents/IN1100.pdf; Kumar, S. (2010) "Improving Building Sector Energy Efficiency in India: Strategies and Initiatives."

[10] Mathur, A. (2007) "Energy Efficiency in Buildings in India: An Overview." Bureau of Energy Efficiency.

[11] McKinsey & Company (2009) "Environmental and Energy Sustainability: An Approach for India."

[12] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute.

[13] McKinsey & Company (2009) "Environmental and Energy Sustainability: An Approach for India."

A leading challenge to efficiency remains that the incentives and drivers for making energy efficiency investments are diffused, and the transaction paths to pursuing these opportunities are unclear to many decision-makers.

There are different types of energy efficiency improvements and practices. Demand-side reductions can be viewed as a hierarchy of actions, often starting with low-cost, low-tech measures and behavioral change, then pursuing more complex whole-building retrofits or renovations, and finally adopting dedicated operations and maintenance to optimize performance over time. These demand-side energy reduction strategies can be matched with supply-side solutions that deploy renewable energy systems. Here, the focus is on retrofits that improve building infrastructure and encompass major equipment upgrades to reduce energy demand and maintenance costs (see Figure 1).

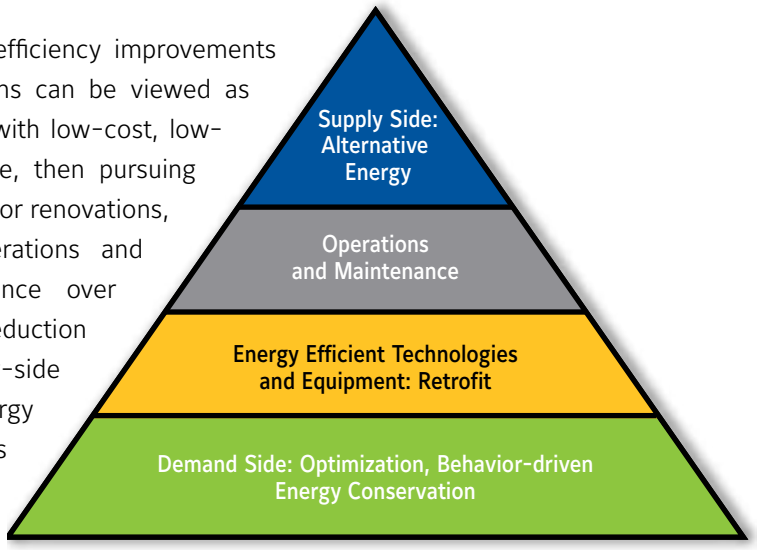

Figure 1: Tiers of Energy Efficiency Improvements

BARRIERS TO INVESTING IN ENERGY EFFICIENCY

In 2009 and 2010, Johnson Controls and the International Facility Management Association (IFMA) conducted a survey of decision-makers responsible for managing commercial and public buildings and their energy-use. The survey found that around the world, the barriers to energy efficiency remain consistent, though the priority may differ.[14] In India, the top barriers to implementing energy savings measures in 2010 were:

- Lack of technical expertise to identify retrofit opportunities (27 percent of survey respondents)
- Limited capital availability (20 percent)
- Insufficient payback (15 percent)
- Uncertainty regarding the energy and cost savings (13 percent)[15]

The BEE and the Indian Renewable Energy Development Agency identified similar barriers in a 2007 report on Energy Services Companies (ESCOs) in the public sector: lack of knowledge from building owners on the performance contracting route for energy efficiency improvements, high transaction costs in preparing documents for bid requests, and a lack of true ESCOs who understand the ESCO concept and who can bring in third-party financing for the projects.[16]

In a 2009 analysis, the World Resources Institute (WRI) pointed to the lack of engagement from Indian Banks as financiers as a key barrier to building retrofits. It also noted a concern from prospective clients on the industry's domination by "vendor" ESCOs that are technology-biased rather than providing comprehensive energy management services.[17] Decision-makers in India also require a more rapid payback than other regions: Most ESCO projects require a payback for efficiency measures of less than two years, compared to a global average of 3.1 years.[18,19] According to a 2008 World Bank report, developing countries

[14] Johnson Controls and IFMA (2010) "Global Energy Efficiency Indicator 2010." Available at: http://www.institutebe.com/InstituteBE/media/Library/Resources/What%27s%20New/EEI-2010-Global-Full-Report-ENG.pdf.

[15] Johnson Controls and IFMA (2010) "India Energy Efficiency Indicator 2010." Available at: http://www.institutebe.com/InstituteBE/media/Library/Resources/What%27s%20New/Summary_2010-EEI-Results-INDIA.pdf

[16] IREDA (2007) "Analysis of Indian Experience with ESCO Delivery of Energy Efficiency for the Public Sector."

[17] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute.

[18] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute.

[19] Johnson Controls and IFMA (2010) "Global Energy Efficiency Indicator 2010" Available at: http://www.institutebe.com/InstituteBE/media/Library/Resources/What%27s%20New/EEI-2010-Global-Full-Report-ENG.pdf.

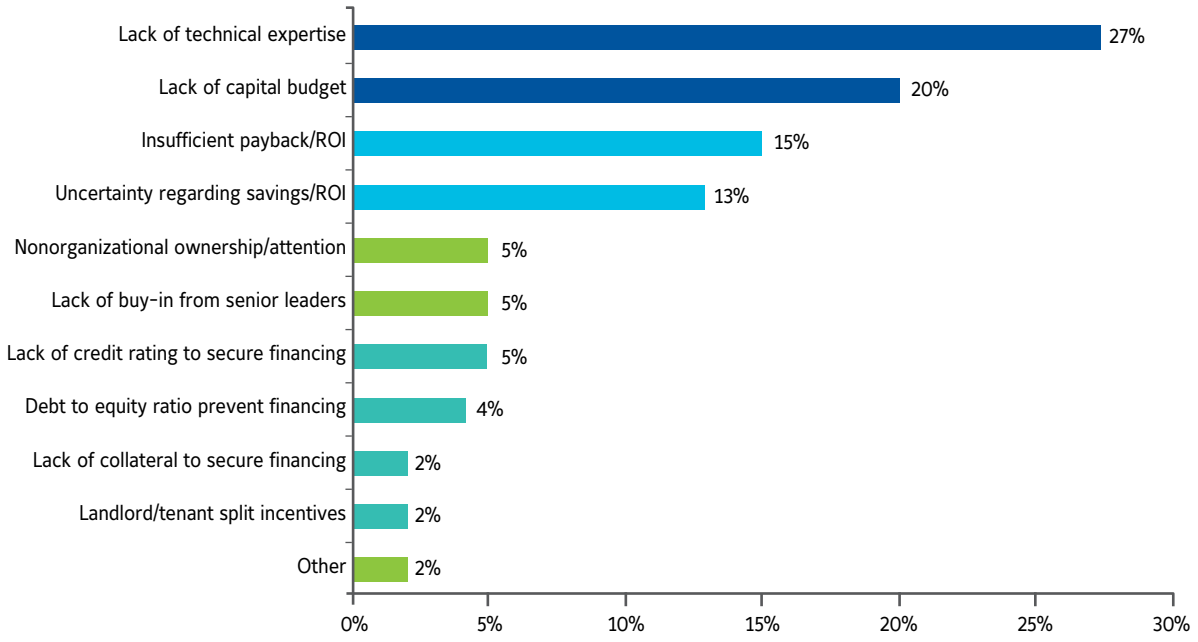

Figure 2: Barriers to Energy Efficiency in India

in general have had difficulty launching energy service business models at scale due to immature contractual systems that do not easily accommodate the complexity of energy performance contracting.[20]

[20] Govindarajalu et al (2008) "Financing Energy Efficiency: Lessons from Brazil, China, India and Beyond." World Bank.

Yet energy efficiency is on many decision-makers' minds. The India Energy Efficiency Indicator survey indicates that 85 percent of respondents are paying more attention to energy efficiency now than they were in 2009, and 91 percent say that energy efficiency is a priority in planned new construction and retrofit projects. Respondents expect energy prices to climb by 17 percent during 2010 and say improving energy efficiency in buildings is their most important carbon management strategy.

Decision makers in India are recognizing the benefits of energy efficiency retrofits in existing building stock, but the challenges associated with retrofit projects, compounded by an immature ESCO market, have kept this market from reaching its potential. The promotion of new business models such as EPC through ESCOs is one model for scaling efficiency efforts.

PERFORMANCE CONTRACTING: A PROVEN TOOL FOR SCALING EFFICIENCY INVESTMENT

EPC is a proven, scalable, and internationally recognized procurement method for reducing the operating costs and environmental impacts of buildings at low risk to property owners.

Definition of Energy Performance Contracting

Under an EPC<, an ESCO is entirely responsible for providing building energy audits, conducting detailed design and engineering, creating a business case analysis, conducting installation, commissioning improvements, and conducting ongoing measurement and verification (M&V) of savings. Performance contracting

is typically used to purchase comprehensive building retrofits including some combination of energy efficiency, water efficiency, operations and maintenance cost efficiency, renewable energy, and distributed generation. The ESCO brings its technical know-how to provide turnkey responsibility for the project. Importantly, the ESCO assumes performance risk for the project in the form of a long-term financial guarantee to ensure that the projected energy, water, and operational cost savings materialize and are preserved over time. The ESCO takes on the performance risk and provides the client with certainty about cash flows generated from energy savings. The savings are often used to offset the debt service payments to the entity that provides the project financing. By combining EPCs with financing, public and private organizations can implement energy improvements in their facilities without any upfront investment of internal capital and with limited risk.

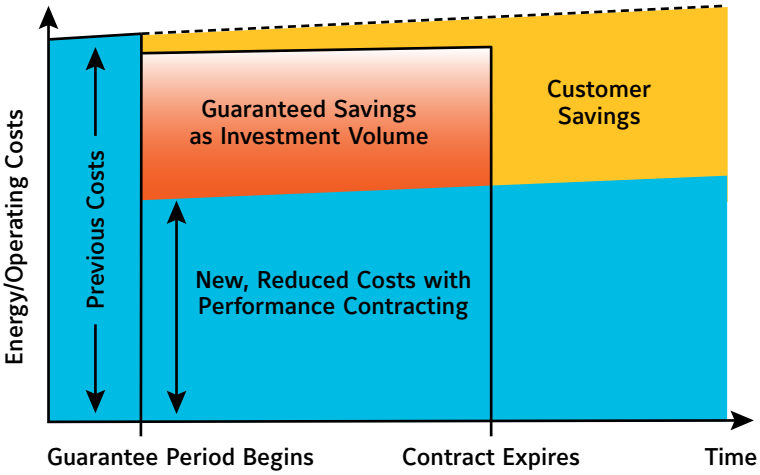

Figure 3: The Performance Contract + Financing Model

In a robust EPC market, ESCOs can implement viable projects in a relatively short time. EPC contracts were first introduced in the U.S. in the late 1970s.[21] Despite a few iterations of the model, projects have demonstrated significant savings in North America and are showing signs of similar success in Europe. For example, the Federal Buildings Initiative (FBI) in Canada has helped facilitate more than 85 retrofit projects, attracting $320 million (Rs. 1,400 crore) in private investments. In the U.S., EPCs were responsible for $375 million (Rs. 1,700 crore) in private investment at U.S. Federal government sites in 2006.[22] As an industry, reported revenues by ESCOs for 2008 were $4.1 billion (Rs. 18,600 crore) and are projected to be $7.1 to $7.3 billion (Rs. 32,200 to 33,100 crore) in 2011.[23]

Figure 4 depicts the EPC process.

1. During the preliminary assessment, the ESCO analyzes the energy use and characteristics of the building, catalogs possible improvement measures, and quantifies the savings and cost associated with each measure.
2. The customer makes a commitment to a contractor.

Figure 4: The EPC Process

[21] National Association of Energy Service Companies (NAESCO) Available at: http://www.naesco.org/resources/esco.htm.

[22] Shonder, Morofsky et al (2010) "Best Practice Guidelines for Using Energy Performance Contracts to Improve Government Buildings." International Energy Agency.

[23] Satchwell, Goldman, et al (2010) "A Survey of the U.S. ESCO Industry: Market Growth and Development from 2008 to 2011." Lawrence Berkeley National Laboratory.

3. The ESCO performs an investment-grade audit (IGA) or detailed analysis of packages of several facility improvement measures and the financial return and savings for each package. This information is delivered in a detailed proposal for the building owner.
4. During the contract phase, the building owner selects one of the bundled packages of measures, works with the ESCO to outline a detailed project installation plan, and secures financing from a third-party lender, leveraging the performance guarantee.
5. Project installation entails implementation and construction of the measures outlined in the contract.
6. The ESCO often provides ongoing maintenance services to maintain savings over time and performs continuous M&V to ensure that guaranteed energy savings are realized over the contract term.

(See the Appendix for a detailed table outlining the different elements and approaches of the most common EPC models.)

CURRENT STATE OF THE EPC MARKET IN INDIA

Under the provisions of the Energy Conservation Act of 2001, the government of India established the Bureau of Energy Efficiency (BEE) to assist in developing policies and strategies to reduce the energy intensity of the Indian economy, with a focus on market principles. Thanks to the work of the BEE, India has seen growth in demand for energy conservation measures over the last decade.[24] Both the private and public sectors have shown a greater interest in energy conservation measures. Commercial buildings employ energy efficiency strategies due to rising energy costs and a desire to increase cost-competitiveness, and government agencies are making a greater effort to procure energy services. Several recent policies also govern building efficiency, including:

- **Energy Conservation Building Code (ECBC)**
  The ECBC code, launched in June 2007, specifies mandatory energy performance requirements for the design and construction of commercial buildings or building complexes that have a connected load of 500 KW or greater.
- **Green Rating for Integrated Habitat Assessment (GRIHA)**
  GRIHA, a green-building design evaluation system, is suitable for all kinds of buildings in different climatic zones across the country.
- **IGBC-LEED rating system (Indian Green Building Council)**
  LEED is a third-party certification program and the nationally accepted benchmark for the design, construction and operation of high-performance green buildings. LEED India projects have to meet and exceed the ASHRAE 90.1-2007 standards.
- **BEE Star Labeling Program**
  The Star Rating Program for buildings with a connected load of 500 kW and above is based on actual building performance in terms of specified energy intensity (kWh/sq m/year). The program rates office buildings on a 1 to 5-Star scale – 5-Star buildings being the most efficient – and criteria have been defined by building category and climate zone.
- **A variety of other policies focus** on energy efficiency in manufacturing and other industrial sectors and are essential for India to reach its sustainable development goals. These include the Perform, Achieve, Trade (PAT) program, which began in April 2011 and seeks to reduce energy and emissions from more than 700 of India's top industrial consumers.

[24] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute.

BEE considers the promotion of delivery mechanisms for energy efficiency services as one of ten "thrust areas" in its action plan, and also recognizes the strong potential of the ESCO performance contracting model in delivering energy savings. India's ESCO industry has already seen some growth over the past five years. WRI estimates a compounded annual growth rate of 95.6 percent from 2003 to 2007, with ESCOs saving clients an average of 20 to 25 percent on baseline energy costs. However, competition in the Indian ESCO industry remains low as the high growth is shared by a small number of firms. In 2007, the six largest companies accounted for 84 percent of that year's total revenues ($17.7 million or Rs. 80 crore).

One characteristic of the ESCO market in India is that many "vendor ESCOs" dominate the market. These are often equipment companies that focus on sales of a single technology, rather than a suite of energy conservation measures. Given that these companies are limited by their specific technology package, customers may not yet differentiate or understand how to evaluate the different choices in EPC/ESCO transactions. The Energy Efficiency Indicator study in 2010 pointed to lack of technical expertise to evaluate opportunities as the single biggest barrier facing decision-makers in India.[25] There is an additional potential problem with the vendor ESCO model when viewing India's ambitious goals to cut energy consumption: Vendors that focus on a single technology rather than a suite of energy conservation measures tend to have smaller balance sheets upon which they can finance customer equipment contracts.

In comparison to peer economies, China and Brazil, the growth of India's ESCO industry is particularly slow. Brazil's annual industry revenue was $344 million (Rs. 1,600 crore) in 2008, and China's was $280 million (Rs. 1,300 crore) in 2006 and growing.[26,27] However, with the BEE's active promotion of the ESCO model, the agency's most recent list of accredited or empanelled vendors, updated in October 2010, included 89 companies, a jump from the 26 identified by WRI in 2007.[28] There are nine vendors rated in the Tier 1 category and 22 listed as Tier 2.[29]

As policy and market demand converge, there is enormous growth potential for building efficiency and the ESCO market. Frost and Sullivan estimate a CAGR of 18.8 percent from 2009 to 2014 in the India energy management services market, which includes ESCOs, consultants, energy saving product manufacturers, and energy management companies. Revenues are projected to reach $598.6 million (Rs. 2,700 crore) by 2014.[30] ESCOs are well positioned to take advantage of the high growth in energy efficiency services because they offer fewer performance risks and provide guaranteed savings to their clients. ESCOs are also capable of designing deep retrofit projects that capture all feasible savings, rather than installing energy saving measures on a piecemeal basis. ESCO project developers think holistically about buildings and energy systems, providing a full array of retrofit options. This expert, integrated, whole-building approach results in a project with a better economic scenario and better environmental outcome. It also enables the blending paybacks from:

- Shallow retrofit projects involving only the lowest-capital-cost and shortest-payback measures.
- Deep retrofits – major improvements that reduce energy use to the greatest extent possible.

Projects that include more than lighting retrofits have a median electricity savings of about 20 percent of the total utility bill.[31]

Despite these growth projections, the overall investment required to achieve India's energy efficiency targets is approximately $16.3 billion (Rs. 74,000 crore),[32] indicating that less than 5 percent of the market potential has been tapped to date. In conversations with industry, the BEE has also expressed frustration with the small number of Tier 1 energy service companies that respond to public tenders for integrated energy retrofit projects.

[25] Johnson Controls and IFMA (2010) "Global Energy Efficiency Indicator 2010."

[26] Delio, Lall, and Singh (2009) "Powering Up: The Investment Potential of Energy Services Companies in India." World Resources Institute

[27] Govindarajalu et al (2008) "Financing Energy Efficiency: Lessons from Brazil, China, India and Beyond." World Bank.

[28] Bureau of Energy Efficiency. List of 89 accredited ESCOs on 21.10.10. Available at: http://www.bee-india.nic.in/schemes/documents/ecbc/89%20ESCO%20List.pdf.

[29] Bureau of Energy Efficiency. List of 89 accredited ESCOs on 21.10.10. Available at: http://www.bee-india.nic.in/schemes/documents/ecbc/89%20ESCO%20List.pdf.

[30] Frost & Sullivan (2010) "Analysis of Outsourced Real Estate Services, Energy Management, Project Management and Facilities Management Markets."

[31] Goldman, C.A., N.C. Hopper, and J.G. Osborn (2005) "Review of the US ESCO industry market trends: an empirical analysis of project data." Energy Policy. 33 (3): p.387-405.

[32] Bureau of Energy Efficiency, as cited in The Business Standard (2009) "India to invest Rs 74,000 cr in CO2 emission cutbacks." Available at http://business.rediff.com/report/2009/dec/07/india-to-invest-rs-74000-cr-in-co2-emission-cutbacks.htm.

POLICY RECOMMENDATIONS FOR GROWING THE EPC MARKET IN INDIA

Based on the experience of global ESCO markets, there are three recommended best practices that support successful growth in the use of EPCs for efficiency improvements. The recommendations are meant for both public-and private-sector retrofit projects, but it is assumed that the BEE will initially target government buildings to establish a familiar transaction pathway for these projects.

1. Establish a Policy Framework for EPCs and a Standard Design Build Procurement Process

EPC enabling legislation for government agencies

A prerequisite for the EPC model to be applied successfully in government-and commercial-sector buildings is the existence of a policy and legal framework to support it.[34] Most countries with substantial EPC markets today required legislation to enable government agencies to obligate funds beyond their normal 12 month budget cycle, use operating budgets to pay for capital equipment upgrades, to enter into EPCs with private companies. National policy or legislation, as opposed to action from the provincial or municipal levels, creates consistent procurement practices countrywide, making it easier for ESCOs to grow and work in multiple regions. Additionally, legislation should include the following components:

[34] Shonder, Morofsky et al (2010) "Best Practice Guidelines for Using Energy Performance Contracts to Improve Government Buildings." International Energy Agency.

- **Common definition for EPC as a design-build procurement model**

  The BEE defines an ESCO as a consultancy group that engages in a performance-based contract with a client firm to implement measures that reduce energy consumption and costs in a technically and financially viable manner. Adding a common definition for EPC across India would add credibility to these contracts and the market as a whole, and provide a clear procurement model for both clients and vendors. This definition should include turnkey project responsibility, assumption of performance risk through the guaranteed savings model, and M&V by the contractor. It should also lay out provisions for a comprehensive set of energy efficiency, water efficiency, O&M cost efficiency, renewable energy, and distributed energy generation improvement measures.

  Design-build is an approach where a project's design and construction are included within one contract and are implemented by a single point of contact. This allows the customer to select a contractor based on the greatest value, rather than the lowest bid, and also results in savings on a number of fronts including lower administration costs, streamlined design process, improved communication, enhanced quality of work, and a compressed project schedule that allows the project to move forward faster.

- **Promote standardized, streamlined, and transparent project development and vendor selection process**

  A challenge faced by the BEE has been establishing an ESCO project development and procurement process that will meet government expectations while increasing the number of Tier 1 ESCOs that respond to public tenders for integrated energy retrofit projects. A lack of transparency in the selection process today keeps large and experienced ESCOs from participating in this market. Following the example of developed ESCO markets and building from a design-build procurement definition, the policy framework should include a stepwise description of the permitted EPC contracts and vendor selection process during early project development.

In the selection process, government buildings need to ensure that they are getting the best-valued EPC bid, and ESCOs also need sufficient information to offer a bid without using resources to prepare an investment-grade audit when they will still be competitively assessed. Indian decision-makers may be interested in reviewing the U.S. BOMA/CCI model and a model developed in Europe, called the Eurocontract two-stage model (see appendix for descriptions of both models).[35,36] These two approaches offer pathways that balance the interests of the government building decision-maker and the ESCO by having the building owner provide basic information that creates the data foundation on which qualified ESCOs could bid. Once the most competitive bidder is chosen, that ESCO would carry out an investment-grade audit as the basis for the EPC agreement, ensuring that the terms remain as attractive as the initial bid.

- **Umbrella contracts and ESCO pre-selection**

  Umbrella contracts that allow agencies to undertake multiple energy projects under the same standard agreement and a list of pre-qualified ESCOs reduce project development time so that buildings can realize energy and cost savings much more quickly. Due to the complexity of EPCs and building managers' unfamiliarity with the EPC procurement process, many governments with successful EPC programs either pre-negotiated many of the standard terms and conditions or provide model contracts that individual sites can customize to fit their needs.

  The government might also pre-qualify ESCOs so that requests for qualification do not need to be issued for each individual EPC. Pre-selecting qualified ESCOs lessens the risk for vendors in an immature market and motivates ESCOs to solicit work by designing comprehensive projects for potential clients in their region. For instance, in the U.S., ESCOs are pre-selected by region and seek to design projects with the deepest savings *before* solicitations, knowing that they have a good chance of acquiring business. Qualifying criteria might include the existing gradation of ESCOs, previous experience on similar projects, capabilities to raise financing, and previous project client rating.

The Federal Energy Management Program (FEMP) of the U.S. Department of Energy has developed a successful standard model, and associated tools and guidance documents, to help federal agencies implement energy savings performance contracts (ESPCs) more easily. Energy performance contracting has been used in U.S. federal buildings since 1995, and the U.S. Congress recently passed legislation as part of the Energy Independence and Security Act of 2007 to promote and permanently authorize the use of EPCs in federal agency buildings. FEMP streamlined the Super ESPC model through indefinite-delivery, indefinite-quantity (IDIQ) contracts with pre-selected ESCOs. Before IDIQ contracts in the U.S., annual awards averaged less than $25 million per year. Since 1998, when the IDIQ model was introduced, the average has grown to more than $300 million per year, with 90 percent of EPC project investment using IDIQ contracts. Canada's Federal Buildings Initiative (FBI) also uses a model contract and maintains a list of pre-qualified ESCOs that can bid on Federal retrofit projects.

[35] "Building Owners and Managers Association International and Clinton Climate Initiative Energy Performance Contracting Model." Available at: http://www.boma.org/resources/bepc/Pages/default.aspx.

[36] Berliner Energieagentur GmbH (2008) "Eurocontract – European Platform for the Promotion of Energy Performance Contracting."

2. Provide Training and Assistance to Agencies/Building Owners

In its efforts to grow the ESCO industry, the BEE has already taken some important first steps to facilitate early projects by providing resources and training for project implementation. The BEE should continue to focus on these efforts.

- **Resource Centre**

  The BEE is working closely with Energy Efficiency Services Limited (EESL), which is intended to serve as a capacity-building resource center for EPCs in India.[37] Incorporated as a joint venture of NTPC Limited, Power Finance Corporation (PFC), Rural Electrification Corporation (REC) and Powergrid Corporation, with an equity base of $41.9 million (Rs. 190 crore) from equal contribution from the four promoters, EESL's purpose is to develop a viable ESCO industry, and to undertake the market-based implementation actions under the National Mission on Enhanced Energy Efficiency (NMEEE). EESL has a variety of objectives including:

  – Facilitate the preparation of energy efficiency projects for demand side measures

  – Implement schemes, programs, and policies of the central and state governments or its agencies

  – Partner with private ESCOs and other companies to promote energy efficiency

  – Provide consultancy services in the field of energy efficiency

  – Identify and impart training to build the capacity of stakeholders.

  Figure 5 shows how EESL may serve as the implementing agency for ESCO projects in buildings and municipalities. Under this model, there will be a tripartite agreement between the State Designated Agency (SDA), building owner, or urban local body (ULB) AND EESL.

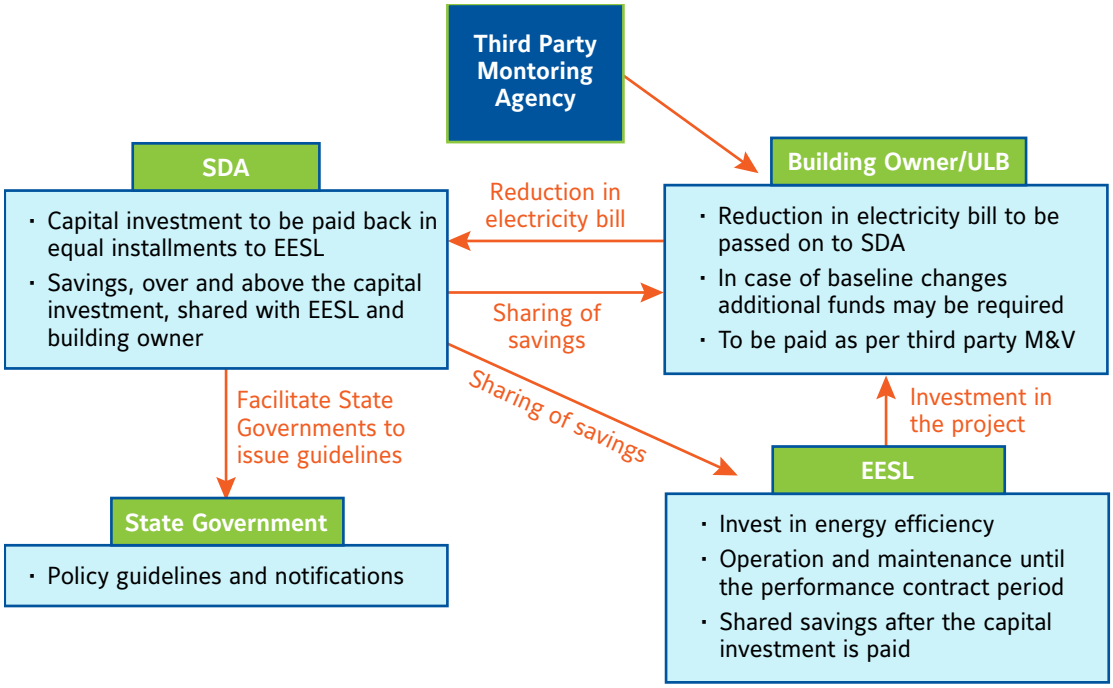

Figure 5: EESL as the implementing agency for ESCO projects[38]

[37] Energy Efficiency Services Limited. Available at: http://www.eesl.co.in/website/.

[38] Energy Efficiency Services Limited. Available at: http://www.eesl.co.in/website/Municipality.aspx.

- **Project facilitators or consultants**

  In developed EPC markets, many governments facilitate new projects by providing customers with some form of technical and contracting assistance. Project facilitators or consultants help agency staff navigate the process, reducing the time required to implement projects and minimizing the use of agency resources by assembling the right team and providing education and dedicated assistance to reduce agency workload. Project facilitators plan communication with routine conference calls and lead process meetings. They also have the experience to guide agencies on best practices and ensure that agency partnerships with ESCOs are balanced, meaning both sides are subject to open, transparent and standardized procedures and protocols. EESL has taken on this role by providing consulting services for energy efficiency and project development, as well as for the various activities related to the Clean Development Mechanism program implementation.

  FEMP now requires the use of a project facilitator in all projects awarded under its IDIQ ESPCs. The experienced project facilitator guides an agency's acquisition team through the process of developing and awarding a Super ESPC delivery order. This service is free through the initial proposal review stage. Canada also identifies and provides project facilitators with technical and EPC experience who can review and assess proposals. In Germany, there is a network of quasi-public and non-governmental procurement agents that assist public agencies throughout the procurement process.

- **Document Templates**

  Building owners and ESCOs in India could benefit from common model contract documents that could be used and tailored for particular sectors or regional and local governments. Creating standard, yet customizable, project development agreement (PDA) and EPC contract templates would streamline project development, reduce confusion for building owners, contractors, and financiers, and generally help to stimulate the building retrofit market in India. The BEE has jointly developed guidelines and templates for municipalities and other stakeholders to use when navigating the energy efficiency project development process and should widely broadcast the existence of this manual.[39]

- **Standardized Measurement and Verification**

  EPCs should include well-defined requirements for M&V of savings. Since the defining feature of the EPC contract model is the performance guarantee, the verified delivery of saving is one of the most important activities associated with implementation. ESCOs typically conduct regular M&V of energy savings and submit their results in an annual report to building owners in order to ensure ongoing equipment performance and assess compliance with the performance guarantee. M&V confirms the value of building efficiency upgrades – especially important in an immature ESCO market like India's where the uncertainty surrounding energy and cost savings is a top barrier to facility retrofits.[40]

  The cost of the M&V services is generally capitalized into the overall project cost. It includes ensuring that installed equipment is performing to specifications, and performing calculations of the project's actual energy savings. Ongoing M&V of resource savings helps protect an owner from savings degradation that could result from deteriorating or failing equipment performance.

[39] "India Manual for the Development of Municipal Energy Efficiency Projects" (2008) Bureau of Energy Efficiency, Alliance to Save Energy, and International Finance Corporation.

[40] Johnson Controls and IFMA (2010) "India Energy Efficiency Indicator 2010."

Different organizations have spearheaded different methods – The International Performance Measurement and verification Protocol (IPMVP), ASHRAE Guideline 14, and FEMP Guidelines are all protocols that provide guidance and instruction for quantifying the results from energy-savings projects. See the Appendix for descriptions of the different M&V methodologies associated with each standard.

Many member countries participating in the International Energy Agency (IEA) Annex 46 are using the International Performance Measurement and Verification Protocol (IPMVP), which provides transparency to the customer and assurance that energy and water savings are accurately and fairly counted. The IPMVP is an overview of current best practice techniques available for verifying results of energy efficiency, water efficiency, and renewable energy projects in commercial and industrial facilities.

3. Stimulate Third-Party Financing

Perhaps the most important focus necessary for propelling the growth of the EPC market in India is to increase the availability and use of financing beyond the capital and operating budgets of the building owners and ESCOs. There are several steps that can be taken to improve the flow of capital into EPC investment opportunities in commercial buildings in India.

Local government building occupants and agencies may not have the authority to borrow money for renovations and retrofits under existing rules (only the federal and state governments in India are able to access external financing). Therefore, innovative financing structures for local government buildings may require different contractual arrangements. This could include using a modified contractual approach involving back-to-back agreements between a financing body and an ESCO and the building owner and the ESCO. Further research is needed to see whether the shared savings model using third-party financing (Figure 7, Option b) or using a special purpose entity (SPE) with an energy efficiency services agreement or shared savings agreement (Figure 9) would be the preferred route for local and city government buildings. Per current practice with EESL (Figure 5), an intermediary could help this model become more pervasive.

- **Promote third-party financing EPC models such as the guaranteed savings model.**
  In an EPC, there are a number of forms in which the ESCO can assume performance risk or the financial investment for projects. It should be noted that this discussion focuses on the evolution of contract models and project financing in developed countries: There might be other models more appropriate to conditions in India. Financing is an area that particularly needs further exploration and research, including direct engagement and interviews with market participants. The models discussed here are proven options and can serve as a guide for additional models needed to scale up energy efficiency investment in India. Even though contracting models might develop differently, financing remains central to all variations of the ESCO model of energy efficiency delivery. Figure 6 shows the evolution of EPC models as ESCO markets have matured in the U.S. and Canada.

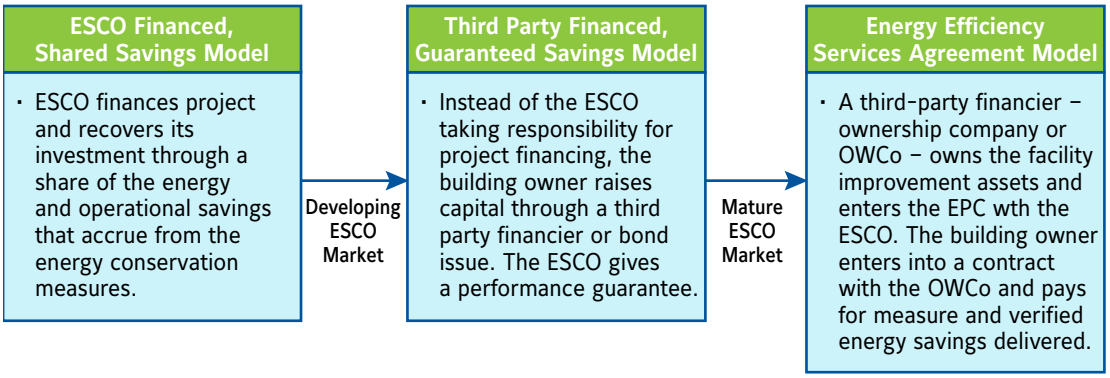

Figure 6: EPC Model Development

ESCO-financed, Shared Savings Model

Early ESCO markets often use the shared savings model where the ECSO finances projects for its customer and then shares the operational savings with the customer. Under this approach, the ESCO itself funds the capital investment in the upgrades (or obtains a loan for project costs) and puts this on its balance sheet. The customer and the ESCO agree to share energy and other operational cost savings in a proportion determined by contract. In many cases, the ESCO benefits from a higher percentage of savings in the first years of the contract in order to recoup its investments in installed equipment. The building owner thus benefits from increased savings over time. In addition, this model provides the ESCO with a direct incentive to maximize savings over time. In India, vendor ESCOs that offer solutions based on one technology rather than a comprehensive suite of measures rely heavily on the shared savings model.

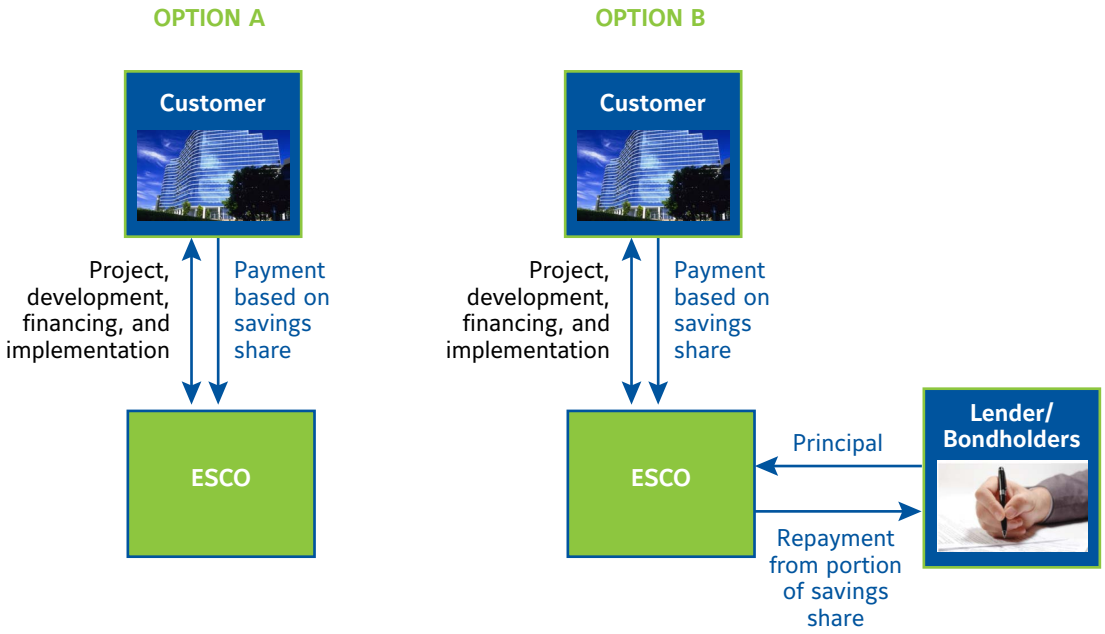

Figure 7: Shared Savings Models

As EPC markets mature, they generally evolve toward greater use of the *third-party financed, guaranteed savings model.* Under this approach, the ESCO does not fund the upgrades itself. Rather, a bank or third-party financier provides the capital for the project through a capital lease, or the customer issues a bond to raise funds for the project. The ESCO assumes the performance risk for the project through a long-term guarantee to the building owner that the efficiency improvements will lead to a certain level of energy savings over the lifetime of the contract. Under the terms of the performance contract, the ESCO is obliged to pay the owner or install additional efficiency capabilities for any shortfall in the amount of guaranteed savings that is revealed during a regular M&V process.

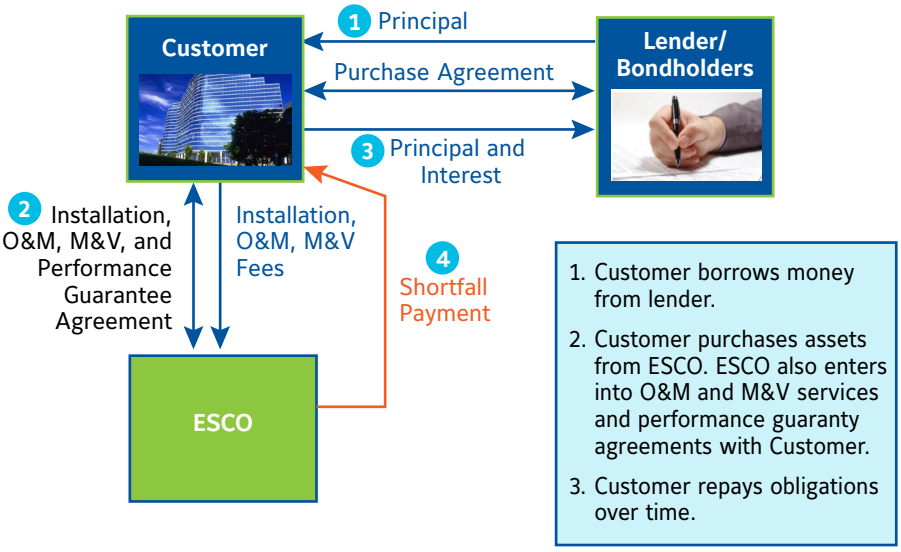

Figure 8: Third-Party Financed, Guaranteed Savings Model

The third-party financed, guaranteed savings model has several important benefits. One of the most critical is that this type of EPC allows for ***more rapid scaling of capital inflow*** for energy efficiency improvements. Rather than relying on the growth of ESCO balance sheet capacity, the guaranteed savings model harnesses financial institutions both large and small to provide project financing. ESCOs using the shared savings model assume both credit and performance risks, whereas ESCOs using the guaranteed savings model only assume performance risk. Credit risk is assumed by a third-party financial institution that is better positioned to manage such risk cost effectively and therefore makes the guaranteed model more cost-effective. The guaranteed savings model also tends to result in fewer disputes between building owners and ESCOs, since there is an agreed-upon payment between the two parties from the beginning, rather than a reliance on measuring accrued savings that need to be divided. As a result of all these differences, India is likely to see greater Tier 1 ESCO participation if it standardizes and promotes the guaranteed savings model.

A third form of an EPC is the *third-party financed, energy efficiency services agreement model.* Like the guaranteed savings model, this approach leverages financial institutions to scale capital availability. However, under this model, the financier retains ownership of the facility improvement assets. The ownership company enters into a guaranteed savings performance contract with the ESCO. Yet, the arrangement between the building owner and the ownership company is a contract in which customers pay on the basis of measured and verified energy savings delivered (or "negawatt-hours" generated). These third-party financing approaches could use either a *shared savings model or an energy efficiency service agreement* (aka a negawatt purchase agreement).

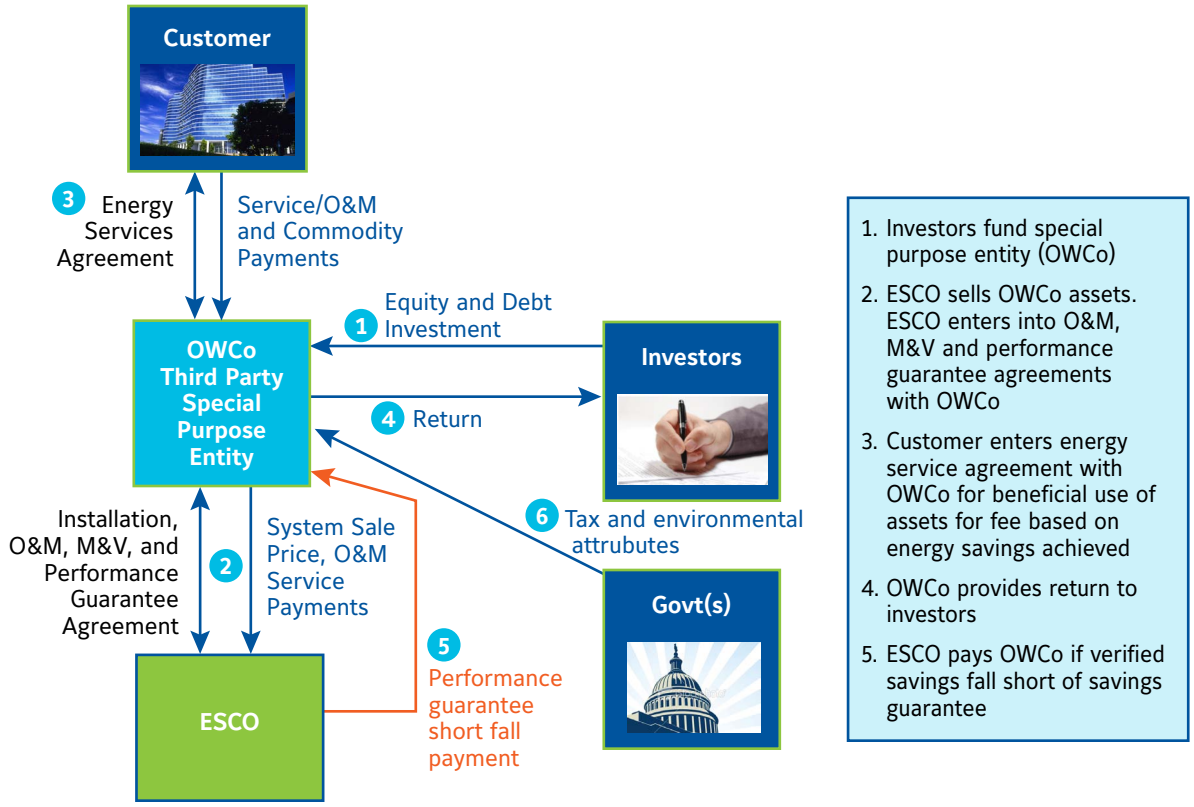

Figure 9: Energy Efficiency Services Agreement or Shared Savings Model Using Special Purpose Entity

This third approach combines the best of both worlds: Like ESCO-financed shared savings, the customer only pays on the basis of delivered savings. But it also allows for rapid scaling of the market by bringing in-party financing, rather than relying on ESCOs to raise the capital necessary for projects themselves.

- **Educate and build EPC technical capacity within financial institutions.** For third-party financing to scale effectively, significant education is required. There is a challenge in convincing commercial banks of the business opportunity that lies in financing EPC projects. While a variety of public and private financial institutions have expressed support for EPC market development (see list below), more banks must genuinely develop, provide, and promote financial products specifically for energy efficiency projects. This is a real challenge due to the small project sizes, the transaction costs, and the lack of new property created in projects to provide the lenders with collateral security. Typically, the equipment undergoing retrofits is already under a lien by the building mortgage holder, making it difficult to use upgraded equipment as collateral to the efficiency lender.

As mentioned earlier, EESL will play a key role in serving as a resource center for financial institutions' capacity building related to the technical details of EPC project finance.

- **Support early success of third-party financiers through loan guarantees or revolving funds.** The India government can take a variety of approaches to leverage limited public funding and reduce risk for initial lenders, and to lower the cost of capital for building owners and agencies that adopt EPC.

Under the umbrella of the NMEEE initiative, the BEE is establishing a $20.9 million (Rs 95 crore) Partial Risk Guarantee Fund (PRGF). This risk-sharing mechanism will provide commercial banks with a partial coverage of the risk involved in extending loans for energy efficiency projects. The fund will act as a first-loss and subordinated recovery guarantee, to be placed in a guarantee reserve account and paid out to participating banks in the event of loss or default. The amount paid out will be equal to the agreed upon percentage of the outstanding principal and will not cover the interest or other fees owed to the bank. The lending banks will also pursue recovery procedures in the event of default, and will pay into PRGF any monies recovered after first satisfying their own receivables. The PRGF will be managed by BEE, an independent trust, or a bank.

The PRGF is an important step to engage commercial financial institutions to help them build capacity to finance energy-efficiency projects on a commercially sustainable basis.

CONCLUSION

As India looks to address its development challenges and achieve its energy goals, clear contracting and financing models for energy efficiency retrofits in buildings are needed. EPCs have successfully spurred a market for ESCOs across the globe by giving policymakers and financiers certainty around the energy and cost savings of efficiency improvements. This certainty in savings through M&V is critical not only for the credibility of the performance guarantee, but also for creating project demand – only with both drivers will the market go to scale.

Defining a policy framework and standard design-build procurement process, providing training and assistance to agencies and building owners, and stimulating third-party financing are common elements in developed ESCO markets. India can take steps toward reaching its market potential by considering these recommendations a roadmap for institutionalizing the EPC process.

APPENDIX

Global EPC models

U.S. Department of Energy, Federal Energy Management Program (FEMP) Model

The Federal Energy Management Program of the U.S. Department of Energy has developed a successful standard model, and associated tools and guidance documents, to help federal agencies implement energy savings performance contracts (ESPCs) more easily. FEMP streamlined the Super ESPC model, which provides umbrella contracts that allow agencies to undertake multiple energy projects under the same contract, using ESCOs selected by the Department of Energy. The DOE's contracts with the ESCOs are called indefinite-delivery, indefinite-quantity (IDIQ) contracts.

FEMP offers two types of ESPC programs: regional and technology-specific. Regional Super ESPCs allow agencies in one of six U.S. regions to place delivery orders with pre-selected ESCOs. Technology-specific Super ESPCs allow any federal facility to access financing for projects that feature on-site renewable energy technologies.

There are five stages in the FEMP Super ESPC Process including: 1) project planning 2) preliminary project proposal and ESCO selection 3) investment grade audit (which is followed by a task order using the Super ESPCs) 4) construction and 5) performance monitoring through M&V reports.

Building Owners and Managers Association and Clinton Climate Initiative Model

The U.S. Building Owners and Managers Association (BOMA) and the Clinton Climate Initiative (CCI) released an EPC toolkit in 2009 that included a model project development standard. The process begins when the property owner or contracting authority defines project criteria. Providers who are short-listed are then invited to submit more detailed proposals, which include a preliminary opportunity assessment. This assessment allows the owner and the ESCO to preliminarily assess project scope, cost and savings so that all parties are prepared to obtain appropriate buy-in from key decision-makers. While the preliminary opportunity assessment is a best estimate of the ESCO's experience and expertise, it does not have a guarantee behind it.

From this step, the ESCO with the most attractive proposal and qualifications will be selected as the prime contractor, and a project development agreement (PDA) is then negotiated with the building owner. The building owner will most likely arrange project financing at this point. During this phase, the ESCO conducts an investment grade audit (IGA), which gives the ESCO a greater level of certainty about project costs and expected savings. Under most PDAs (also known as IGA contracts), the owner agrees to pay the cost (as fixed cost or percentage of total project cost) for the ESCO's completion of the IGA in the event that the ESCO proposes a project that meets the owner's defined criteria and the owner decides not to proceed with project implementation.

Upon completion of the IGA, the ESCO proposes a performance contract with a detailed final scope of work, schedule of payments, forecast of energy savings, and M&V plan. Under the BOMA/CCI model process, the ESCO must provide a guaranteed maximum price (GMP) for the recommended project through transparent pricing, including breakdown of labor cost, material cost, margin, and cost savings for the project by type of measures or even by energy conservation measures. Under CCI's gain sharing provision, any reduction of final project cost below the GMP is to be shared between the ESCO and the owner in a negotiated split.

Finally, when the performance contract is agreed to, work begins and improvement measures are implemented. The "performance" phase begins upon or during project completion, whereby the ESCO provides M&V services.

Eurocontract – Single-Stage and Two-Stage Model

Eurocontract was an EU-funded project that ran from 2005 through 2007 to accelerate the market for energy services. The model allows for two different procurement processes: single-stage or two-stage.

Under the single-stage model, which is common for simple buildings, building owners prepare the project by compiling and evaluating all necessary building data, determining the energy cost baseline of a given reference year, and performing a rough analysis of the energy and cost savings potential. The building owner then issues an invitation to tender that forces the prospective contractors to provide an energy saving guarantee based only on the building data prepared by the owner and on a rough analysis (performed by the ESCO). From these, the owner selects bids and negotiates a contract. The single-stage model requires sufficient detailed up-front preparation work on the part of the building owner to provide all necessary information to the ESCOs. It is intended to result in more competitive bidding among ESCOs and to lower costs for the building owner.

The two-stage model is generally intended for more complex buildings. The first steps are similar to the single-stage model in that the building owners gather data and assess savings potential. Subsequent steps, however, resemble the BOMA/CCI project development model and include a project development

agreement and an investment-grade audit: the selected ESCO must provide a fine analysis to verify the project cost and possible cost savings potential before finalizing and executing the performance contract. If the results of the fine analysis confirm the savings potential determined through the rough analysis phase, the property owner can either order project implementation to begin or can decide against implementation. If the work is not ordered, the owner is required to pay the contractor for the fine analysis (based on the costs agreed in the planning contract).

The chart below highlights the key differences among these models.

Key Attributes	FEMP	BOMA/CCI	Eurocontract
Remuneration	Allows guaranteed and shared savings models. EPC paid upfront. Service and M&V on ongoing basis.	Allows guaranteed and shared savings models. EPC paid upfront. Service and M&V on ongoing basis.	Assumes a shared savings model.
Financing Methods	Equipment provided through third-party capital lease financing. Customer may opt to pay any portion of project cost up front.	Customer pays for work using either own funds or third-party financing.	ESCO responsible for financing energy saving measures (forfeit model).
Selection Process	ESCOs are pre-selected for each of size major Super ESPC regions. ESCOs compete on preliminary proposals.	Customer first short-lists ESCOs based on a RFQ responses. Selects ESCO based on preliminary opportunity assessments and interviews.	Single-stage: Competitive bidding, binding offers, and contract award based on owner spec and rough analysis. Two-stage: ESCO selected for fine analysis based on preliminary proposal.
Pre-Selection and/or Selection Criteria	Track record, credit worthiness, experience, innovations.	Innovative solutions, technical approaches, economic return on investment (ROI), project management and delivery methodology, past service performance, terms and conditions.	
Streamlining	Allows agencies to undertake multiple energy projects under same umbrella contract: indefinite-delivery, indefinite-quantity (IDIQ) contracts.	Promotes use of standard model contract document template.	Promotes use of standard model contract document template.

Key Attributes	FEMP	BOMA/CCI	Eurocontract
Pricing	Not-to-exceed pricing. Complete pricing transparency for all material, labor, and services offered and a fixed-percentage markup applied.	Guaranteed maximum price (GMP) and transparent price breakdown of labor cost, material cost, margin, and cost savings by FIM category or even FIM.	Cost transparency required for equipment to be installed even though fees based on shared savings.
Allowable Savings Sources	Energy, water, material/commodity used, and external labor fees measured on ongoing basis. Sources of savings (customer's equity cash outlay, deferred maintenance, avoided future capital cost, and internal labor) must be negotiated.	Energy savings measured on ongoing basis. Any other savings (water, avoided capital cost, labor, etc.) may be negotiated by parties.	Reduction in either energy consumption and/or demand based on contractually agreed reference prices.
Guaranteed or Shared Savings item	Volumetric energy usage savings + O&M cost savings	Volumetric energy usage savings + O&M cost savings	Energy expenditure savings
Measurement and Verification (M&V) Methodology	Requires IPMVP	Requires IPMVP	Does not use IPMVP
Surplus/Deficit	In case of deficit, ESCO must pay shortfall. Any savings beyond guarantee retained by customer.	In case of deficit, ESCO must pay shortfall. Any surplus can be used to offset a deficit in immediate year after, but any surplus that rolls over more than one year accrues to customer.	Deficit partially or/wholly offsets ESCO fee. Surplus shared per negotiated percentage breakdown.
Termination	Neither party has right to terminate contract without cause.	Customer may terminate contract for convenience and without cause, for which customer must provide 10 days' written notice.	Neither party has right to terminate contract for convenience.

Measurement & Verification (M&V)

IPMVP

The most recognized standard for M&V is the International Performance Measurement and Verification Protocol (IPMVP). There are four compliance paths. Options A and B focus on subsystems, while C and D address whole buildings.

IPMVP Option	Description	Example
Option A	Retrofit Isolation, partially measured, savings calculated on a combination of measured (pre and post) and stipulated factors.	Replacing T12 lamps and magnetic ballasts with T8s and electronic ballasts. Savings is the number of lamps and ballasts installed times the difference between pre- and post-retrofit power measurements times the stipulated lighting hours.
Option B	Retrofit Isolation, all parameters measured pre and post.	Replacing an old chiller with an efficient one to provide the same cooling load. Take measurements on old chiller to create part-load efficiency curves. Continuously meter both cooling load and power consumed by new chiller. Savings calculated as actual energy usage predicted using model of older chiller minus energy usage of new chiller.
Option C	Whole facility (e.g., utility bill comparison). Baseline energy usage model accounting for weather, occupancy, etc. Used to predict energy usage of a facility without retrofits.	Installing a bundle of energy efficiency improvements to building envelope, HVAC system and lighting. Savings is the difference between utility bills energy usage predicted by baseline model and energy usage shown on utility bill.
Option D	Comparison with calibrated computer simulation model of component or whole-building energy usage.	Incorporating energy efficiency into the design of a new building. Savings is the difference between modeled or actual building energy use and the energy model of a comparable building built to code.

ASHRAE Guideline 14

ASHRAE Guideline 14 covers three M&V approaches and defines four compliance paths. Each of the three ASHRAE 14 approaches has a unique performance compliance path and just one of the approaches (whole building) allows for an alternate prescriptive path. IPMVP options A and B line-up directly with ASHRAE 14's retrofit isolation approach. IPMVP Option C lines-up directly with ASHRAE 14's whole-building approach. The goal is to calculate the total (or net) savings from a project of one or more CMs by measuring only the total energy use and demand of the building. IPMVP Option D lines-up directly with ASHRAE 14's calibrated simulation.

FEMP Guidelines

While IPMVP is a framework of definitions and broad approaches, FEMP M&V Guide is an application document based on the 1997 version of IPMVP prepared for the federal government sector. The FEMP guide is more directed in its guidance on the application of different M&V options for specific energy conservation measures. Additionally, IPMVP requires the use of limited metering under Option A, whereas FEMP M&V allows an M&V approach that does not use metering for some measures.

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