



Ministry of Power and
Energy Sri Lanka

WB Energy Efficiency Program Support in Sri Lanka



Sri Lanka Sustainable
Energy Authority

Implementation and Financing Mechanisms in Commercial, Public & Industrial Buildings Sectors

National Consultation and Dissemination Workshop

November 10, 2022

ESCO Program Business models and Overview of Transaction Documents



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Sri Lanka Sustainable Energy Authority

National Workshop on Implementation and
Financing Mechanisms in Building Sector



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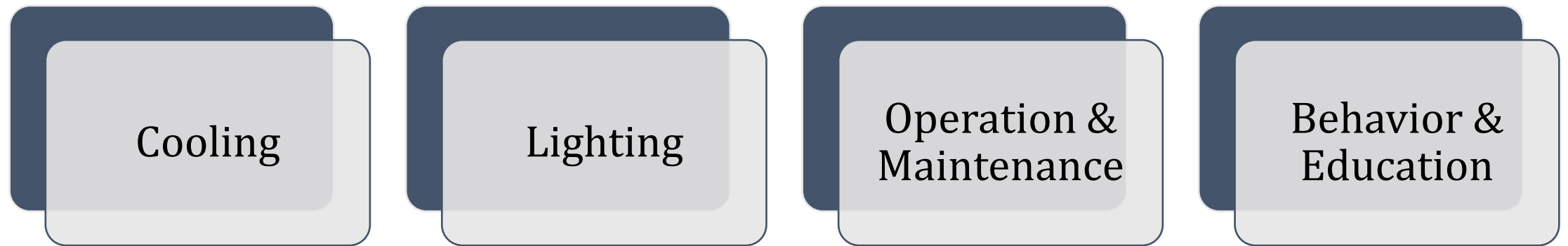
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No Cost and Low-cost Energy Savings Measures



No cost and low-cost measures can typically provide 5% to 20% (or even more in some cases such as lighting) of energy savings in the existing buildings.

Source: Multiple literature documents (1) US DOE document - Energy Saver 101 Infographic: Home Cooling. (2) Lighting – Article on Motion Sensor Application on Building Lighting Installation for Energy Saving and Carbon Reduction Joint Crediting Mechanism - MDPI

Cooling Measures

1. Calibrate thermostats to ensure that temperature readings are correct, and adjust temperature set points for seasonal changes.
2. Set back the thermostat in the evenings and other times when the building isn't occupied.
3. Perform monthly maintenance of cooling equipment to guarantee efficient operation throughout the year.
4. Regularly change or clean HVAC filters (monthly) during peak cooling requirements. Dirty filters cost more to use.
5. Use shades and blinds to control direct sun through windows in peak summer to prevent heat gain.
6. Make sure that areas in front of vents are clear. More energy is required to distribute air if your vents are blocked.
7. Clean the evaporator and condenser coils on air-conditioners, or chillers. Dirty coils inhibit heat transfer, clean coils saves energy.
8. Repair damaged insulation and replace missing insulation with thicknesses calculated for the operating and ambient conditions of the mechanical system.
9. Balance air and water systems.
10. Install variable frequency drives (VFDs)



Lighting Measures

1. Install occupancy sensors to automatically turn off lights when no one is present and back on when people return. Occupancy sensors can save between 15 and 30 percent on lighting costs.
2. Maximize daylighting. Open or close blinds to make the best use of natural daylight and take advantage of skylights or other natural daylight sources to reduce lighting during daytime hours.
3. Use task lighting where feasible.
4. Implement a regular lighting maintenance program.
5. Remove unnecessary lamps (de-lamp) in over lit areas. Check your light levels against standards from the Building Code to see if you have areas that are over- or under-lit.



Operation and Maintenance

1. Conduct a nighttime audit to find out what's ON after hours that shouldn't be.
2. Improve operations and maintenance practices to ensure that the equipment is functioning efficiently.
3. Optimize start-up time, power-down time, and equipment sequencing.
4. Revise janitorial practices to reduce the hours that lights are turned on each day. Consider switching to day-cleaning, which takes place while occupants are in the building.
5. Review and emphasize the financial and environmental results of a preventative maintenance program for major systems and components.
6. Visually inspect insulation on all piping, ducting and equipment for damage (tears, compression, stains, etc.).
7. Repair leaking faucets and equipment. A dripping water faucet can leak hundreds of gallons per year.

Behavior & Education

1. Create a mechanism for occupants to share their energy-saving ideas or suggestions. May even offer a reward for the achievements.
2. Share energy efficiency goals. Encourage actions that apply to most of your employees' workspaces, or that can be practiced at work and at home, like turning off lights when not in use and activating computer power management features.
3. Display the past 6–12 months of energy use information in a high-occupancy area or distribute it as part of a regular report. Seeing the data and any trends in energy use can inspire occupants and employees to contribute to continued savings.
4. Print and hang banners, posters, and signs with energy-saving messages.
5. Hold a webinar, or present about why it's important to save energy at internal meetings, or other get-togethers. You can also integrate information about your energy program into your organization's orientation training.

Case Study | Examples

EE Measures for a 5-star hotel in Colombo, Sri Lanka

NO- cost EE measures

| IMPROVEMENT | DESCRIPTION | ANNUAL SAVING (LKR) |
|-------------------------------------|--|---------------------|
| Chillers | Do not operate 300RT chiller | 595,000 |
| Cooling towers | Proper maintenance of towers | 45,000 |
| Condenser water system | Condenser water temperature management | 634,000 |
| Chilled water system | Chilled water temperature management | 995,000 |
| Set back temperature of guest rooms | Set back temperature management | 418,000 |
| Steam system improvements | Rectification of defective steam traps | 3,605,000 |
| Elevators | Optimization of the counter weight | 1,064,000 |

EE Measures for a 5-star hotel in Colombo, Sri Lanka

LOW- cost EE measures

| IMPROVEMENT | DESCRIPTION | INVESTMENT (LKR) | ANNUAL SAVING (LKR) | PAYBACK (YEARS) |
|-----------------------------|--|---------------------|------------------------|--------------------|
| Chilled water system | Replace 3-way valves with 2-way valves | 312,500 | 315,000 | 1.0 |
| Exhaust System | Install a heat recovery wheel for exhaust air | 1,035,000 | 411,000 | 2.5 |
| Boiler System | Burner tuning to increase efficiency | 250,000 | 582,000 | 0.4 |
| Boiler System | Furnace oil heating using steam | 400,000 | 164,000 | 2.4 |
| Boiler System | Air preheating using flue gas recovery | 1,000,000 | 966,000 | 1.0 |
| Steam System | Introduce PRV for pressing and low steam pressure requirements | 150,000 | 524,000 | 0.3 |
| Power System | Replacement of transformer | 2,500,000 | 1,605,000 | 1.6 |
| Laundry | Dryers heat recovery | 1,500,000 | 1,346,000 | 1.1 |
| Kitchen | Improvements to Bain Marie (Food Warmers) | 1,500,000 | 432,000 | 3.5 |



Energy audit and EE measures for a 5-star hotel in Kolkata, India

Summary of findings for low cost and no cost measures.

Reduction in demand load would be – 23KVA on account of the guest room corridor change of lights.

| Srl No. | Measures | Investment. INR | Expected Savings KWhrs/ Year | Expected Cost saving INR |
|---------|--|------------------|------------------------------|--------------------------|
| 1 | guest room Toilet exhaust optimization. | 15,000 | 13,100 | 58,950 |
| 2 | Unoccupied room, FCU fan speed is minimized. | 600,000 | 17,423 | 78,406 |
| 3 | Chiller primary pump optimization | 130,000 | 21,900 | 98,550 |
| 4 | 120W Par lamps changed to 23w CFL, - 155 nos, | 18,600 | 43,900 | 197,550 |
| 5 | Replacing 33 Nos. 75w par lamps to 35 w metal halide in walkway, | 4,000 | 5,780 | 26,010 |
| 6 | Replacing 1400 no.s 50w halogen lamps in guest corridor with 35w halogen, and adding wardrobe sensor. | 70,000 | 183,960 | 827,820 |
| 7 | FDA blower in Pan Asian restaurant is changed with aerofoil blade ADA fan, | 100,000 | 8760 | 39,420 |
| 8 | Tea rooms – 6 no 150w capsule lamp changed to 18w CFL, entrance 70w metal halide replaced by 20w capsule halogen | 1,000 | 4,730 | 21,285 |
| 9 | Weekly filter cleaning procedure implemented to minimize the exhaust fan static in laundry. | NIL | 1,320 | 5,940 |
| 10 | Movement sensors installed in house keeping pantry in guest floors. | 70,000 | 2,800 | 12,600 |
| | TOTAL | 10,08,600 | 300,250 | 1,366,528 |



Energy audit and EE measures for a 5-star hotel in Kolkata, India

Summary of Conservation – From Level II audit.

| Srl No . | Measures | Cost of Implementati on INR | Expected savings KWhrs/Yr | Expected savings in cost INR | Reduction in O&M cost INR | Expected demand reduction KVA | Expected effect on occupant comfort |
|----------|--|-----------------------------|--|------------------------------|---------------------------|-------------------------------|--|
| 1 | Fuel Pump and Burner interlocking | 25,000 | 19,250 liters of HSD | 770,000 | NIL | NIL | Not Applicable |
| 2 | Water Balancing between the primary and secondary circuits | 250,000 | 60,000 | 270,000 | NIL | NIL | Better control of T&RH. |
| 2 | LED lighting for the guest room corridors | 1,800,000 | 275,700 | 1,240,650 | 72,500 | 43 | No change |
| 3 | Replacement of cooling tower with better approach. | 1,500,000 | 28,800 | 129,600 | NIL | NIL | Not Applicable |
| 4 | Replacement of Eden Pavillion restaurant tube lights with LED tube lights. | 1,260,000 | 58,867 | 265,902 | 21,000 | 9.3 | No change |
| 5 | Replacements of basement service area tube lights with electronic ballasts of lower rating and operate only 2 tubes. | 250,000 | 107,475 | 483,636 | 30,000 | 16.8 | Lower intensity, but within required limits |
| 6 | Public area AHUs to be fed with lower chilled water temperature and operate with VFD | 1,000,000 | 35,040 | 157,680 | NIL | NIL | Better T&RH control |
| 7 | Kitchen hood with motorized dampers and VFD for the exhaust fans | 800,000 | 13,688 | 61,596 | NIL | NIL | Better Exhaust from locations which are active & occupied. |
| 8 | Enhanced efficiency of the Laundry and reduction of usage of steam. | 150,000 | 21,500 liters of HSD | 860,000 | NIL | NIL | Not Applicable |
| 9 | Bio-Fuel Generator using the wet garbage from kitchen and restaurant | 500,000 | 18900 kg of LPG | 680,400 | NIL | NIL | Not Applicable |
| | TOTAL | 7,535,000 | 575,570 kwhrs +40750 liters of HSD + 18900kg of LPG | 4,919,464 | 123,500 | 69.1 | |



Cost- Benefit for an Office in Colombo, Sri Lanka

| | EE measure | Energy saving (kWh/Yr) | Demand saving (kVA/Month) | Cost saving (LKR/Yr) | Investment (LKR) | SPB (Yrs) |
|-----------------------|---|---------------------------|------------------------------|-------------------------|---------------------|--------------|
| Low payback | | | | | | |
| 1 | Rectification of existing split type AC units | 5,500 | | 120,000 | 100,000 | 0.83 |
| 2 | Power factor improvement & demand management | | 20 | 264,000 | 50,000 | 0.18 |
| Medium payback | | | | | | |
| 3 | Introduction of split type AC to courier service division | 3,500 | | 75,500 | 200,000 | 2.65 |
| 4 | Redesigning of the lighting system | 52,000 | | 1,139,000 | 2,450,000 | 2.15 |
| High payback | | | | | | |
| 5 | UPS room to be cooled using the packaged units during the day | 1,650 | | 36,000 | 150,000 | 4.18 |
| 6 | Collection of AC condensate water to be fed to the cooling towers | 1,300 | | 28,000 | 115,000 | 4.12 |
| 7 | Solar PV system to be on a covered parking | 157,500 | | 3,433,000 | 20,000,000 | 5.82 |
| Total | | 221,450 | 20 | 5,095,500 | 23,065,000 | 4.53 |

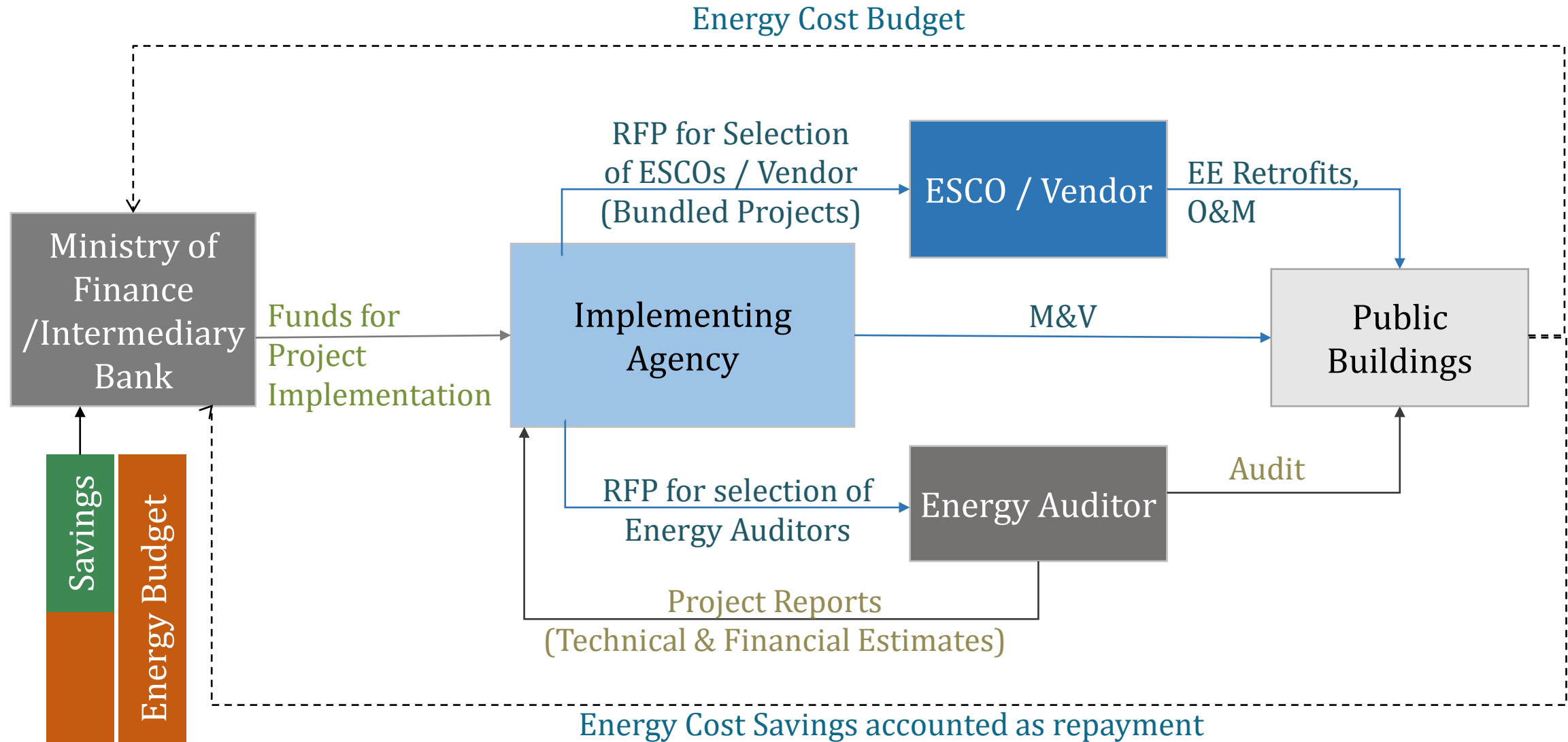


ESCO Program Business models

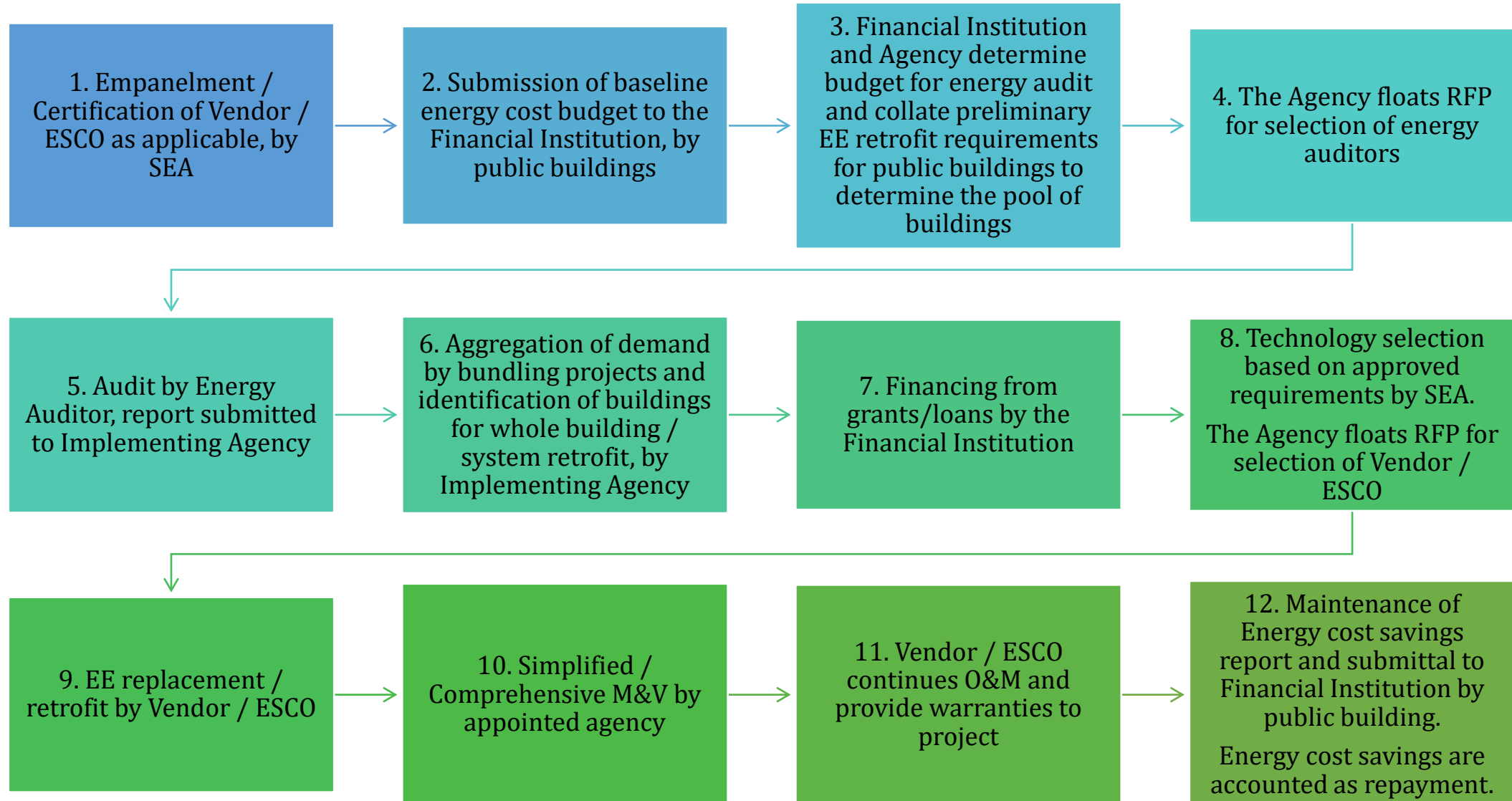
Principles of ESCO Program Design

1. Evaluate energy efficiency opportunities for public, commercial and industrial building sectors.
2. Lower cost of energy efficiency retrofits.
3. Robust measurement & verification procedures.
4. Address technical and financial risk for enhancing energy efficiency financing.

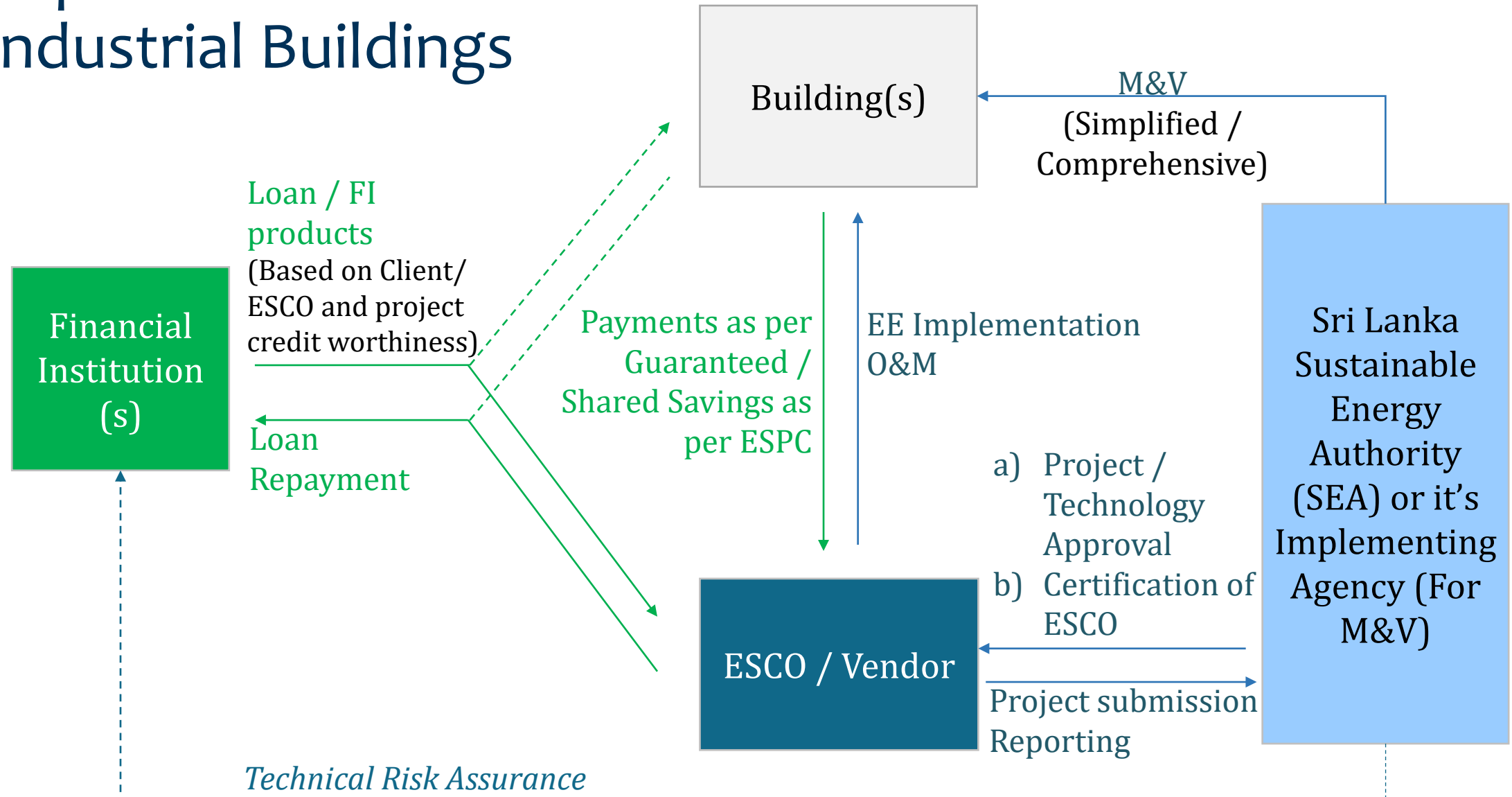
Implementation Framework for Public Buildings



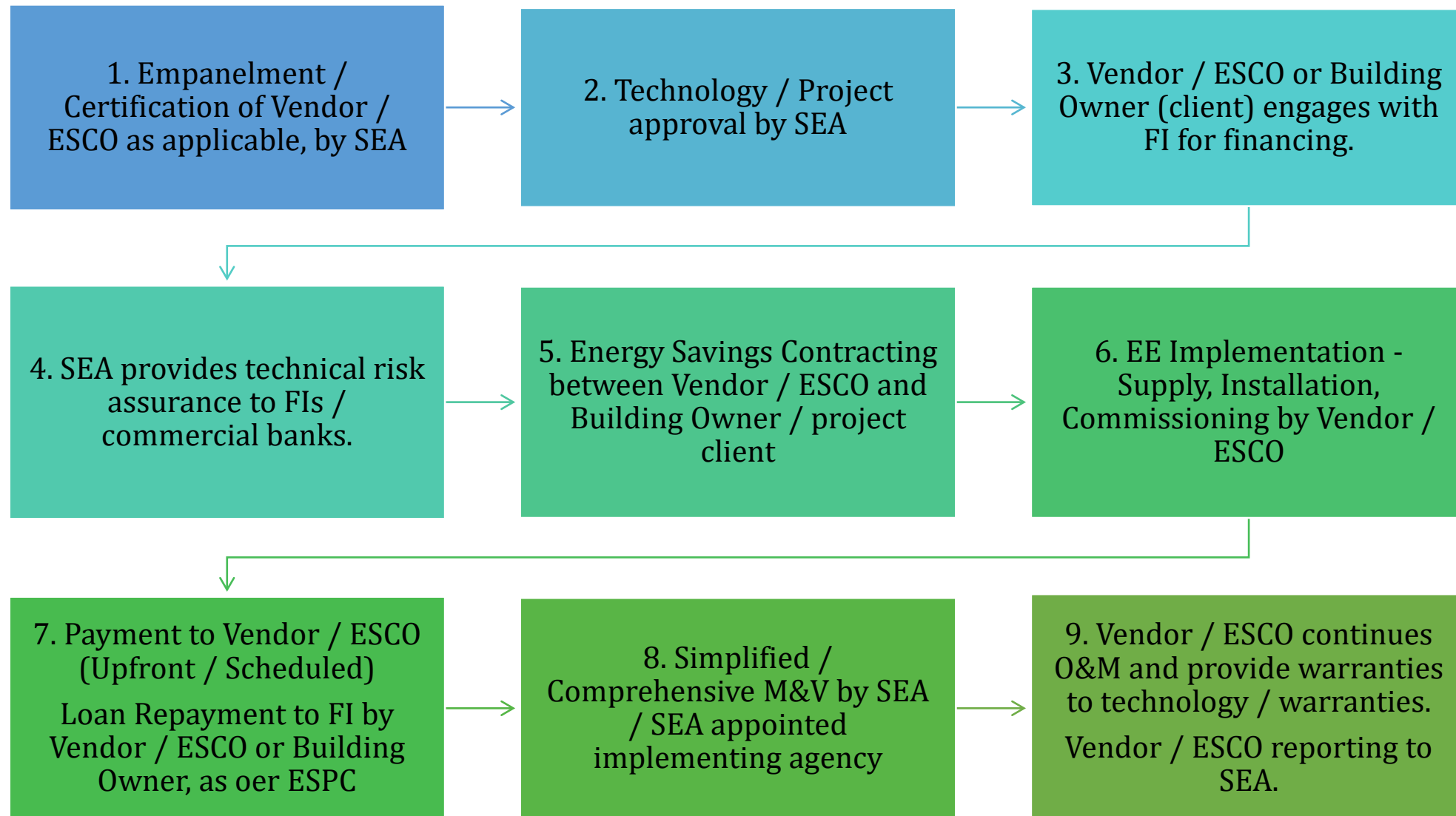
Process Flow



Implementation Framework for Commercial and Industrial Buildings



Process Flow



Roles and Responsibilities

| Stakeholders | Implementation Framework for Commercial and Industrial Buildings | Implementation Framework for Public Buildings |
|---|---|--|
| Ministry of Finance / Intermediary Bank | | <ul style="list-style-type: none"> a) Determine budget for EEI in public buildings. b) Engage with the World Bank (and/ or other development aid / international organizations) to determine details / agreement associated with the line of credit / financing. c) Provide financing for project implementation based on aggregated demand conveyed by SEA. d) Engagement with public building owner for reporting energy cost saving. |
| Sri Lanka Sustainable Energy Authority | <ul style="list-style-type: none"> a) Empanel vendors / technology providers. b) Certification / Accreditation of ESCOs. c) Technology and specification approval d) Project approval e) Measurement and verification (simplified / comprehensive) | |
| | <ul style="list-style-type: none"> a) Provide technical risk assurance to local financing institutions / commercial banks. | <ul style="list-style-type: none"> a) Demand aggregation- facilitating identification of prospective public building for EE retrofits. b) RFP for selection of energy auditors and contracting agreement with energy auditors. c) Review technical and financial estimates provided in project reports by the energy auditor. d) Approve project reports and technology specifications. e) RFP for selection of vendors/ ESCO for EE retrofit. f) Contracting agreement with Vendor/ ESCO. g) Facilitate payment to Vendor/ ESCO and Energy Auditor |



| Stakeholders | Implementation Framework for Commercial and Industrial Buildings | Implementation Framework for Public Buildings |
|--|--|--|
| Local Financial Institutions / Commercial Banks | <ul style="list-style-type: none"> a) Provide financing for respective EE project. b) Evaluate credit worthiness of building owner / ESCO (financial). Technical risk will be assured by SEA. c) Financial agreement with building owner or ESCO/ Vendors (as applicable) | |
| ESCO/Vendor | <ul style="list-style-type: none"> a) Submit application for empanelment / certification to SEA and maintain the same. b) Project application to SEA for approval and secure technical risk assurance from SEA. (If applicable). c) Implementation of EE retrofits – Supply, Installation and Commissioning. d) Compliance for warranty and necessary services as agreed under the contracting arrangement. | |
| | <ul style="list-style-type: none"> a) Identification of prospective buildings for EE retrofits. b) ESCO - Submit project to SEA for approval. c) Vendor – Submit technology specification to SEA for approval. d) Engagement with building owners as per Energy Saving Performance Contract (ESPC) e) Project reporting to SEA. f) Based on the case, engage with financial institutions for: <ul style="list-style-type: none"> – Securing loans or financial products for project financing – Repayment of loan | <ul style="list-style-type: none"> a) Engagement with SEA for payment for respective equipment, technology, or service. b) Provide energy cost saving reporting to public buildings. |



| Stakeholders | Implementation Framework for Commercial and Industrial Buildings | Implementation Framework for Public Buildings |
|----------------|--|---|
| Energy Auditor | | <ul style="list-style-type: none"> a) Conduct walk-through audits b) Conduct feasibility assessment, design optimization, diagnose performance and determine operational patterns to improve energy efficiency. c) Report preliminary technical and financial estimates to SEA |
| Building Owner | <ul style="list-style-type: none"> a) Signing of ESPC and engagement with ESCO/ Vendor and providing necessary support for project implementation. b) Support in implementation of M&V. | |
| | <ul style="list-style-type: none"> a) Reporting to SEA (if applicable) b) Payments as per ESPC. c) Engage with financial institutions for (if applicable): <ul style="list-style-type: none"> - Securing loans or financial products - Repayment of loan | <ul style="list-style-type: none"> c) Submission of budget for EEI to Ministry of Finance. d) Reporting on energy cost savings to Ministry of Finance and SEA. |



c

Energy Saving Performance Contract

Need for ESPC

| | |
|----------------------------------|--|
| Performance Guarantee | <ul style="list-style-type: none">• Provides guidance on covering guarantee for energy savings |
| Fixed Cost | <ul style="list-style-type: none">• Project costs cannot escalate without notice |
| Quality Control | <ul style="list-style-type: none">• Clients have control over equipment chosen for the project |
| Multiple Services | <ul style="list-style-type: none">• Covers multiple services - Audit, Project design, Construction, Energy savings, etc. in one contract |
| Budget-Neutral Services | <ul style="list-style-type: none">• Clients get services without any budget outlay, benefiting risk averse and cash strapped firms |
| Professional Project Maintenance | <ul style="list-style-type: none">• Clients benefit from the ESCO's specialised expertise in energy efficiency |
| Hands-on Training | <ul style="list-style-type: none">• ESPC may include obligatory training clauses that ESCO must provide to nominees of the Client |
| Risk Management | <ul style="list-style-type: none">• Low risk since energy savings security is covered by the ESCO as per contracting terms |

Components of ESPC

Purpose and Project Scope

Feasibility Assessment – Walk Through Energy Audit; Investment Grade Energy Audit

ESCO Services – Activities, Timeline, Energy Savings, O&M, M&V, Training etc.

Client Responsibilities – Accessibilities, Safety, Operating Hours/ Usage

Payment Agreement – Payment Calculation, Terms and Penalties, Billing Procedures, Security

Administrative Clauses – Modification of ESPC, Property Rights, Confidentiality, Indemnification

Legal Recourses – Applicable Jurisdiction, Dispute Resolution, Legal Recourses, Default, Termination

Benefits of ESPC Standardization

- Minimises legal and administrative costs across industry.
- Minimises whetting costs and approval procedures for Financial Institutions.
- Easy for clients to compare with other standardised ESPCs.
- Allows Aggregator ESCOs to issue multiple contracts with project specific customisation.
- Helpful for small to medium size ESCOs to have a standard document.

- Slide for Video



Thank You

Tanmay Tathagat

Environmental Design Solutions Pvt. Ltd.