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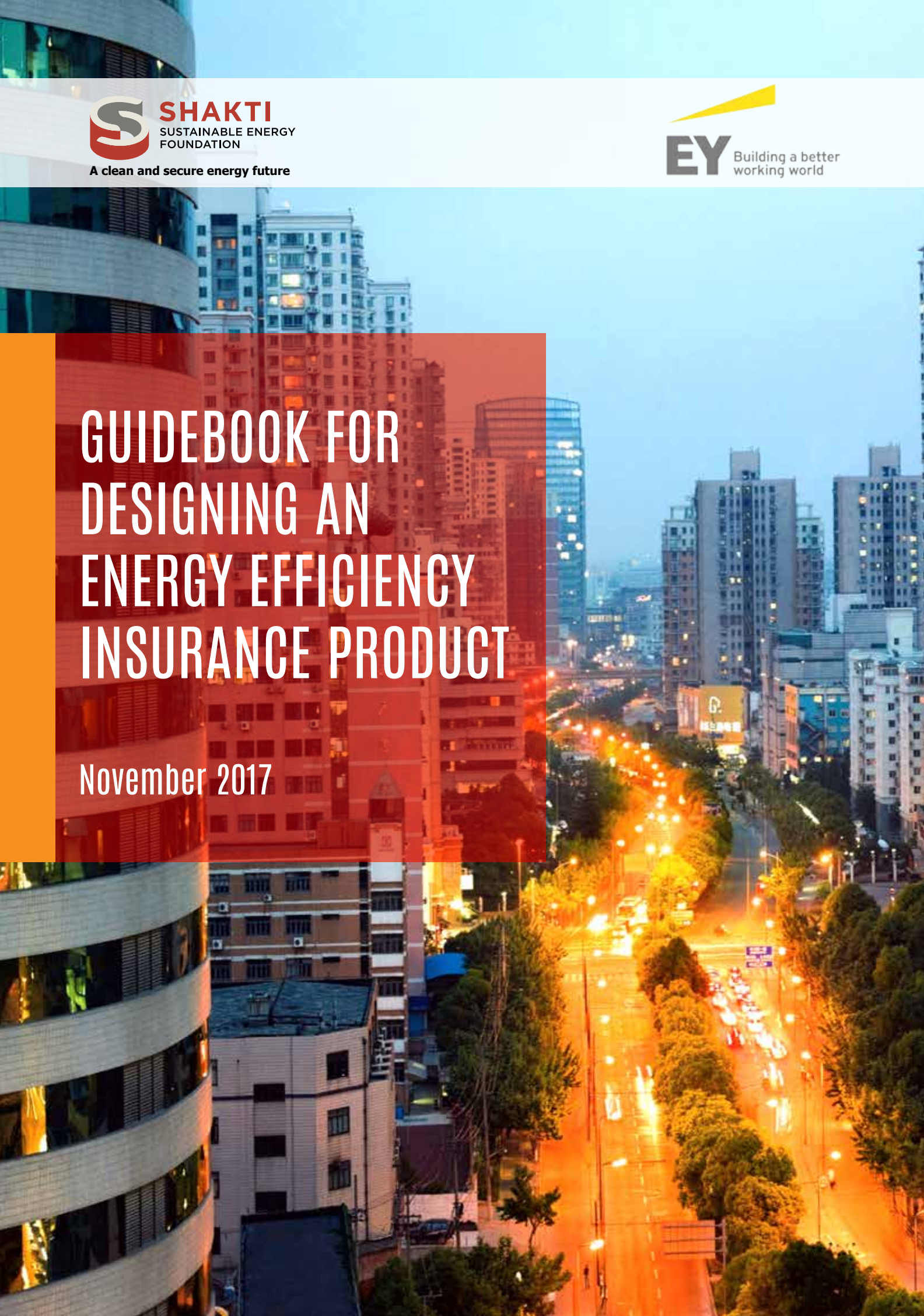
FOUNDATION

A clean and secure energy future

EY Building a better working world



GUIDEBOOK FOR DESIGNING AN ENERGY EFFICIENCY INSURANCE PRODUCT

November 2017

Shakti Sustainable Energy Foundation works to strengthen the energy security of India by aiding the design and implementation of policies that support renewable energy, energy efficiency and the adoption of sustainable transport solutions.

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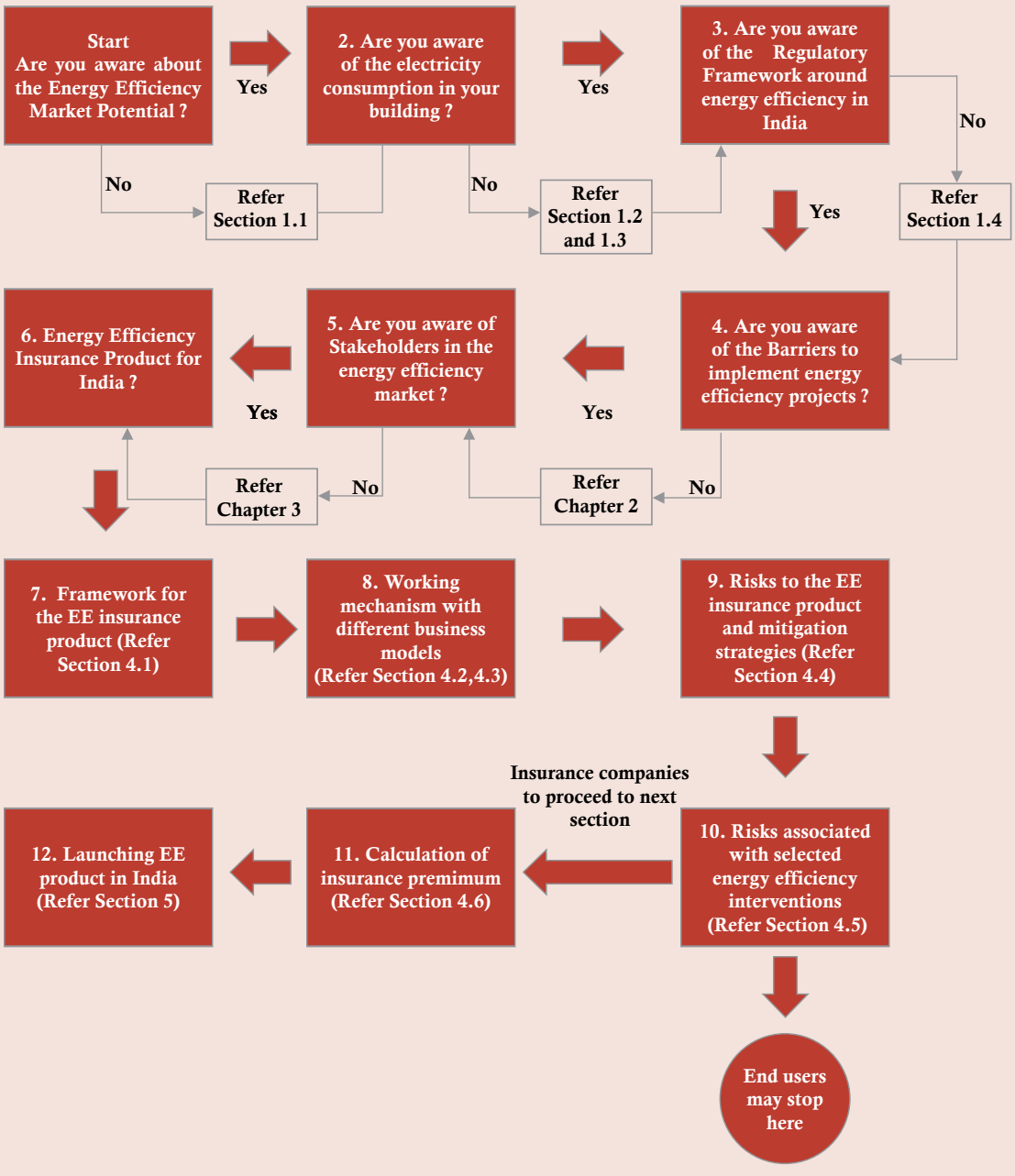
List of Abbreviations

BEE	Bureau of Energy Efficiency
BIPV	Building-Integrated Photovoltaics
BIS	Bureau of India Standards
CAR	Contractor's All Risk Insurance
CFL	Compact Fluorescent Light
DPR	Detailed Project Report
DSM	Demand-Side Management
ECBC	Energy Conservation Building Code
ESCO	Energy Service Company
FDI	Foreign Direct Investment
FIs	Financial Institutions
GRIHA	Green Rating for Integrated Habitat Assessment
HFC	Home Finance Company
HVAC	Heating ventilation and air conditioning
IEA	International Energy Agency
IESNA	Illuminating Engineering Society Of North America
IGBC-LEED	Indian Green Building Council
IRDAI	Insurance Regulatory and Development Authority of India
IRR	Internal Rate Of Return
LED	Light Emitting Diode
M&V	Measurement and Verification
MBD	Machinery Breakdown Insurance
MFC	Master Of Finance and Control
MNRE	Ministry Of New and Renewable Energy
MOEF	Ministry Of Environment &Forest
MOHUPA	Ministry Of Housing and Urban Poverty Alleviations
MOP	Ministry Of Power
MOUD	Ministry Of Urban Development
NAPCC	National Action Plan on Climate Change
NHB	National Housing Bank
PAT	Perform, Achieve and Trade
PMC	Product Management Committee
UIN	Unique Identification Number

Mapping of the guidebook

For the convenience of the reader, the contents of the guidebook have been mapped as shown in the figure below. Furthermore, the map takes into account the varying interest of the reader who might be an end-user or an insurance company.



1 Energy Efficiency Market in Building Sector

India is home to 17.8% of world's population and consumes around 6% of world's primary energy with per capita energy consumption of one-third of global average. The primary energy demand in India has grown from about 450 million tons of oil equivalent (toe) in 2000 to about 770 million toe in 2012. This is expected to increase to about 1250 (estimated by International Energy Agency) to 1500 (estimated in the Integrated Energy Policy Report) million toe in 2030[1]. This increase is driven by a number of factors, the most important of which are increasing incomes and economic growth which lead to greater demand for energy services such as lighting, cooking, space cooling, mobility, industrial production and office automation.

According to the latest estimates, India has one of the highest Gross Domestic Product (GDP) growth rate (7%) in the world[2]. With improvement in living standards of people in India, there will be a greater demand for energy. An emerging economy like India needs a robust energy sector to provide energy access to all its citizens and simultaneously walk a path towards a low carbon economy. Rapid growth in the economy and urbanization will also lead to enormous demand for buildings and consequently energy consumption in the building sector in India.

Building sector accounts for 20.1% of the total delivered energy consumed worldwide[3]. It is estimated that building sector will increase five-fold from 21 billion square feet in 2005 to 104 billion square feet in 2030. Estimates also show that two- third of commercial and high-rise residential structures that will exist in 2030 are yet to be built. Such rapid expansion also presents an opportunity to make a significant contribution to energy savings. Several policies/ programs that govern building efficiency are as follows:

- Energy Conservation Building Code (ECBC)
- Green Rating for Integrated Habitat Assessment (GRIHA)
- IGBC-LEED rating system (Indian Green Building Council)
- BEE Star labelling Program
- 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 and 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.

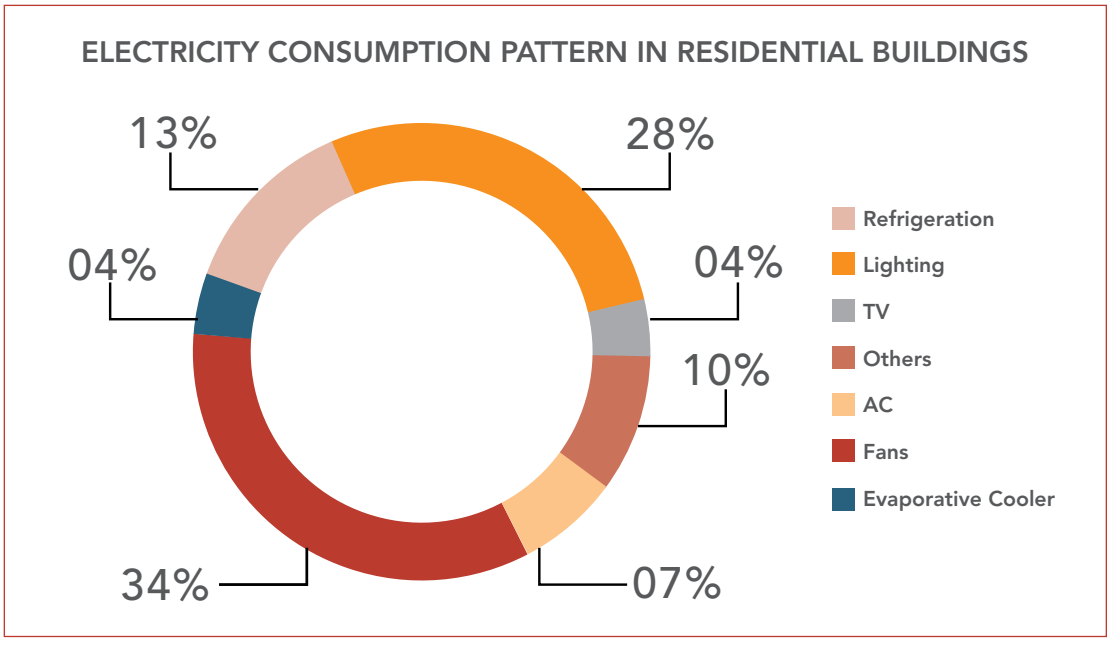
1.1 Market Potential

The overall size of energy efficiency market is estimated to be INR 1.6 lakh crores[4]. Till now, only 5% of this market has been tapped through ESCO mode mainly in the areas of lighting and some industrial applications. The large-scale implementation of energy efficiency is constrained by a number of important regulatory, institutional and financing barriers[5]. Global investment in energy efficiency was estimated to be USD 221 billion in 2015, an annual increase of 6%, with over half of this investment occurring in the buildings sector.

[1] Source: Ministry of Power (http://powermin.nic.in/en/content/energy-efficiency
[2] Source: http://www.tradingeconomics.com/country-list/gdp-annual-growth-rate
[3] Source: https://www.eia.gov/outlooks/ieo/pdf/buildings.pdf
[4] Source: Ministry of Power (http://pib.nic.in/newsite/PrintRelease.aspx?relid=155458)
[5] Source: EESL (http://www.eeslindia.org/User_Panel/UserView.aspx?TypeID=1025)

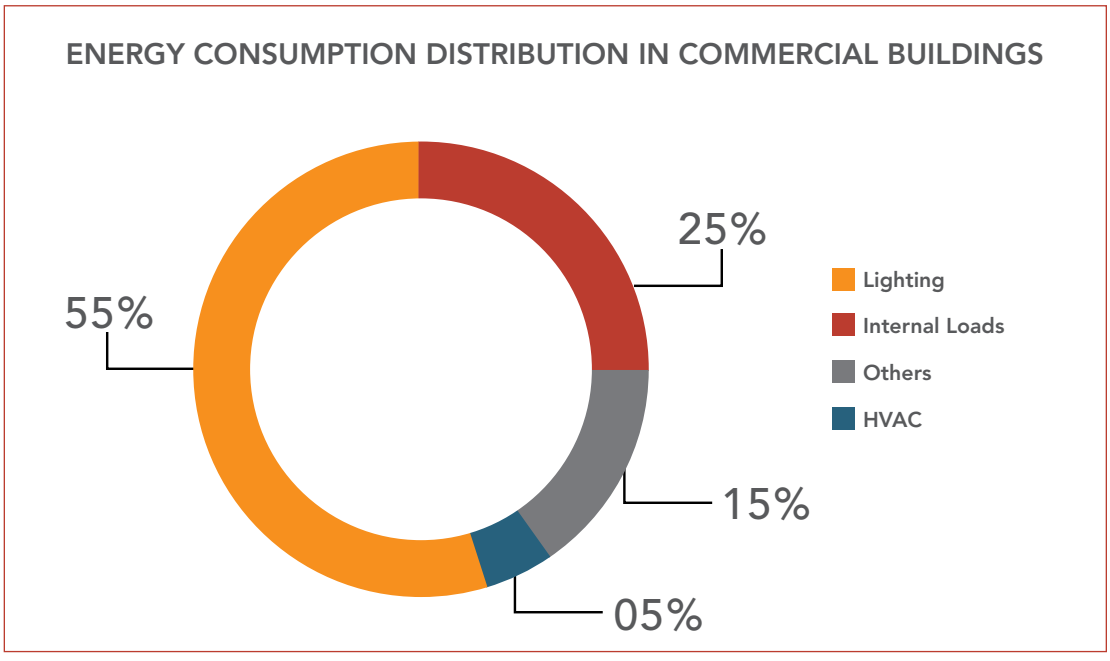
1.2 Electricity Consumption in Residential Buildings

Following figure shows the break up for electricity consumption pattern in the residential building sector[6]: Around 62% of the electricity consumption can be attributed to fans and lighting loads.



1.3 Energy Consumption Distribution in Commercial Buildings

The sector is witnessing a high annual growth rate in electricity consumption. Around 55% of the energy consumption in the commercial sector is due to heating, ventilation, and air conditioning (HVAC) alone. Below figure provides the energy consumption distribution in the commercial buildings[7].



[6] Source: http://planningcommission.nic.in/reports/genrep/rep_carbon2005.pdf
[7] Source: http://planningcommission.nic.in/reports/genrep/rep_carbon2005.pdf

1.4 Present Regulatory Framework around Energy Efficiency in India

In 2001, the government passed the Energy Conservation Act and established a statutory body, the Bureau of Energy Efficiency (BEE), for regulation and promotion. The overall objective of the act was to reduce the energy intensity of Indian economy. BEE's mission is to assist in developing policies and strategies with a thrust on self-regulation and market principles, within the overall framework of the Energy Conservation Act, 2001 with the primary objective of reducing energy intensity of the Indian economy.

In order to achieve a sustainable development path, India launched its National Action Plan on Climate Change (NAPCC) in 2008, with eight National Missions. National Mission for Enhanced Energy Efficiency is one such mission which outlines market based initiatives to enhance energy efficiency. The National Mission for Energy Efficiency seeks to decrease the energy utilized for every unit of production, with a focus on nine energy-intensive industries. Mission's primary strategies include (i) certification of energy savings to allow trading among industries, (ii) efforts to transform markets through provisions to improve the affordability of EE appliances, and (iii) assistance to facilitate finance of multisector demand-side management (DSM) programs. National Mission on Sustainable Habitat is another mission under which energy efficiency in buildings is covered as one of the initiatives.

Under the overall ambit of EC Act 2001 and the NAPCC, BEE has launched several programmes and schemes to promote energy efficiency in Industries, Buildings, appliances and also capacity building programmes for all the stakeholders associated with energy efficiency.

In order to improve energy efficiency in the buildings sector, BEE has introduced ECBC which is under voluntary phase right now and planned to be made mandatory after capacity building and implementation experience. ECBC sets minimum energy standards for commercial buildings having a connected load of 100 kW or contract demand of 120 KVA and above. While the Central Government has powers under the EC Act 2001, the state governments have the flexibility to modify the code to suit local or regional needs and notify them. Presently, the code is in voluntary phase of implementation. About 22 states are at various stages of mandating ECBC, wherein most of building construction activities are happening across the country. Building components include:

Building envelope (walls, roofs, windows)

Lighting (indoor and outdoor), Heating ventilation and air conditioning (HVAC) system

Solar water heating and pumping

Electrical systems (power factor, transformers)

2 Barriers to Implement Energy Efficiency Projects

Despite the excellent potential of energy savings in industrial and building sectors in India, it is difficult to realize the complete potential because of various barriers. An IEA analysis shows that although solutions and technology are readily available, more than half of the potential in the buildings and industry sectors will not be realized by 2035 .

There are various types of barriers that restrict the actual realisation of the potential, some of critical barriers are mentioned below:

Financial Barriers

- Lack of non-recourse finance for energy efficiency projects- A large number of financial institutions (FIs) do not perceive energy efficiency measures as a separate project. Thus, they are unwilling to provide loans without any lien on assets of the parent entity. This makes it difficult for the implementing organization to raise finance for such projects, as most organizations utilize their borrowing limits for their core businesses.
- Reluctance to utilize internal funds for procurement of the energy efficiency equipment or products by project proponent.
- Large initial cost with few EE interventions
- Limitations in bank appraisal methods- Lenders often do not have the capacity to apply suitable appraisal methodologies for EE interventions.
- Concerns about financial strength of ESCOs in India- Poor creditworthiness of borrowers also proves to be a hindrance in financing EE projects.
- Smaller projects may find difficulty in obtaining finance from banks as for small projects, transaction costs are high. This not only makes energy efficiency projects less attractive for conventional bank financing, but also limits the interest of international FIs (such as multilateral and bilateral donor organizations) to whom the scale of financing is important.
- High project development costs ("soft costs")- Soft costs such as project preparatory costs and pre-financing costs such as detailed project report (DPR), feasibility report, consultant, measurement and verification (M&V) of energy efficiency projects are high when compared to their investment scale.
- There is no single standard contracts/agreement that is followed for energy efficiency projects, unlike for renewable energy projects wherein power sale agreements are generally based on tariff policies. Therefore, most bankers/FIs find it difficult to approve lending for energy efficiency projects.

Information Barriers

- Lenders are unfamiliar with EE technologies and approaches and require technical support to appraise and manage lending to EE projects. Lack of in-house technical competencies to gauge the risk posed by the non-achievement of the guaranteed savings and the lack of confidence in the technical analysis and recommendations from the audits performed by ESCOs poses a risk on the third-party lender's investment.

- Low knowledge and experience of the ESCOs in the technologies and their implementation poses technical risk on the ESCOs.
- Draft Report: Designing an Energy Efficiency Insurance Product
- There is limited information available to consumers on performance of various technologies for energy efficiency. While equipment suppliers are adopting measures to meet this gap, there is still more to be done.

Other Barriers: There is also some resistance from builders to invest in EE interventions during construction of a building. This is because of asymmetry in sharing of cost and benefits. Builders feel that while the cost will be borne by them the potential benefits will be enjoyed by the occupants.

3 Stakeholders in the Energy Efficiency Market

Various stakeholders in the Indian energy efficiency market are listed in the table below.

TABLE 1: **Stakeholders in the Indian energy efficiency market**

STAKEHOLDERS	DESCRIPTION
Energy Efficiency Technology/Equipment Provider	Various companies in private sector has made substantial progress, especially in the provision of large-scale manufacturing of energy-efficient equipment and establishing energy service capabilities
Property developers	• Government: A significant proportion of the properties in India are developed by the Government. Central ministries/ departments and state ministries/ departments construct buildings for their own usage or as part of their development plans- offices, housing colonies, hospitals, schools, universities. • Private developers and builders • Public sector undertakings and private companies • Individual plot owners • Service industry • Manufacturers and suppliers of building materials and equipment's
ESCOs	The ESCO business in India began in 1994-95, with a USAID grant to the Industrial Development Bank of India to promote ESCOs. In 1995-96, a USAID sponsored study tour and US mission visit to India resulted in the formation of a small number of ESCOs.
Energy Auditors	As part of its implementation of the Energy Conservation Act 2001, the Bureau of Energy Efficiency (BEE) has initiated a process for certifying energy managers and energy auditors through a rigorous competitive examination.
Financial Institutions	NHB, HFC, Banks, MFCs, FDI
National Ministries	MoHUPA, MoUD, MoEF, MNRE, MoP, BEE, DST
Electrical utilities	There are several ways in which electricity utilities can contribute towards reducing the end-use electricity consumption in residential and/or commercial buildings like introducing time of day tariff, demand response, installation of smart meters, incentives to consumers for reducing electricity bills and educating consumers to reduce electricity consumption.

3.1 Value Proposition for Various Stakeholders in EE Market

Below table shows a problem statement, solution and a value proposition for various Indian stakeholders that will be involved in the energy efficiency insurance product.

TABLE 2: Problem statement, solution and a value proposition for the stakeholder

<table>
<tr><td colspan="4">Problem Statement: Mitigation of risks related to energy savings from interventions to match the investments on EE intervention in buildings with the potential of the sector.</td></tr>
<tr><td colspan="4">Solution: Energy Efficiency Insurance Product</td></tr>
<tr><td colspan="2">Market Potential</td><td colspan="2">Barriers to Investment</td></tr>
<tr><td colspan="2">The overall size of energy efficiency market is estimated to be INR 1.6 lakh crores. Till now, only 5% of this market has been tapped through ESCO mode mainly in the areas of lighting and some industrial applications</td><td colspan="2">Large-scale implementation of energy efficiency is constrained by a number of financial, information and other barriers in India.</td></tr>
<tr><td>Key Participants</td><td>Insurance Product Features</td><td colspan="2">Key activities</td></tr>
<tr><td>Insurance Companies</td><td>Will cover only risks pertaining to savings from EE interventions</td><td>Building Owner:
(a) Enter into a project contract with ESCO
(b) Availing Loan from Bank / FIs
(c) Repayment of Loan</td><td>Verifier:
Verification of the savings proposed by the ESCO to building owner before Insurance cover</td></tr>
<tr><td>ESCOs
Building Owners
Govt.
Banks/ FIs
Independent Verifiers</td><td>Insurance shall take into account the various possible interactions the installed energy efficiency technologies may have with one another.
EE interventions covered related to the following areas:
? a) HVAC (Demand Side)
? b) Lighting (Demand Side)
? c) Alternative Energy Generation (Supply Side)</td><td>ESCO:
(a) Getting an Insurance Cover
(b) Commissioning of equipment
(c) Monitoring and Verification
(d) Project Designing
Availing Loan from Bank / FIs
(e) Repayment of Loan</td><td>Insurance Company:
(a) Evaluation of DPR by ESCO
(b) Regular monitoring and verification of savings from the EE intervention</td></tr>
</table>

Marketing of the Product Following entities can promote the EE insurance product in India: • Govt. (BEE) • Insurance Companies • Financial Institutions • ESCO	**Value Proposition for ESCOs** ESCO will be able to mitigate the various energy performance risks related to the EE interventions at a small cost of premium to Insurance Companies. In return, ESCOs will obtain loan for investment related to the EE interventions as FIs will be more comfortable to lend loans for an intervention that has been backed up with an insurance cover.
Value Proposition for FIs Banks would be more comfortable in lending loans for an investment that can be backed up by an insurance cover as it will reduce the risk of default in loan repayment by the borrower.	**Value Proposition for Building Owner** Easier Loans to building owner for Guaranteed Savings Model: Would be easier to avail loan for investment related to the EE interventions as FIs will be more comfortable to lend loans for an intervention that has been backed up with an insurance cover.
Value Proposition for Insurance Companies Insurance companies would gain from the enormous potential of the sector.	**Value Proposition for Govt.** Investments related to energy efficiency will help Govt. to reduce the CO_2 emission footprint of the building sector.

4 Energy Efficiency Insurance product for India

4.1 Framework for the EE insurance product

a. ***Implementing Agency for the Product:*** Insurance companies

b. ***Sector:*** Energy Efficiency

c. ***Geography:*** India

d. ***Salient Feature of the Insurance Product:***

- **Coverage for risks arising on account of variation in energy savings from energy efficient interventions:** During secondary research it was identified that there are many general insurance products available in Indian market to cover the financial impact due to different risk factors. However, there is no availability of an insurance product that can help mitigate the financial impact due to the risk from the variation in energy savings post implementation of the energy efficient intervention. This is also one of the major concern highlighted during the interaction with ESCOs and is one of the major barrier to the full realization of energy efficiency market potential in India.
- **Energy efficiency interventions areas to be covered by the insurance product:** Insurance product will cover the various demand and supply side interventions in buildings related to the following areas:
  - HVAC (Demand Side)
  - Lighting (Demand Side)
  - Alternative Energy (Supply Side) – Energy generation from Rooftop Solar PV

  Above mentioned areas have been shortlisted on the basis of the energy savings potential in each of these areas in the building sector.
- Insurance product will cover energy savings under guaranteed and shared energy ESCO model in India.
- The insurance shall take into account the various possible interactions the installed energy efficiency technologies may have with one another. For example, replacement of an incandescent lamp with a LED would cause a reduction in the electricity costs but it may also cause an increase in the heating usage due to the heat generated by the incandescent bulb.

e. ***Stakeholders:*** Brief roles and responsibilities of the various stakeholders in the product are as follows:

- **Financial Institutions:** Involvement of financial institution depends on whether financing option has been availed from any financial institution to finance the cost of the installed technologies.
- **ESCO:**
  - ESCO is responsible for the installation and commissioning of the technologies.

- The ESCO will purchase the insurance product for a premium which is can be either paid up-front or on a periodical basis depending upon the terms and conditions of the insurance product. Tenure of the insurance is expected to vary form from one intervention to another.

- **Insurance Company:** Insurance Company will provide the insurance for the annual shortfall in the energy savings to the energy savings insured. Coverage will include the shortfalls caused by various pre-identified risk factors. There will also be certain exclusions that would be a part of the insurance contract. Exclusions are made in the product policy to effectively define the risks covered and to keep the premium low. Some of the exclusions that could be a part of this insurance product are:
  - Inadequate maintenance: The responsibility for maintenance should reside with the ESCO. The requirements for maintenance should be stipulated in the contract.
  - Physical damage to equipment: Physical damage or wear and tear is usually attributed to lack of maintenance by the responsible party.
  - Sabotage/misuse/vandalism of the installed technologies
  - Changes in laws or codes
  - Addition of new end uses that increase energy use: This clause will prevent any claims due to the addition of end uses. Contracts should have a provision for the adjustment of the baseline if new end uses are installed or removed.
  - Changes in energy prices: Contracts should have a provision for the adjustment of the baseline if the energy prices change.
  - Failure or malfunction of data acquisition systems.
  - Verifier: Insurance Company either use the services of an in-house verification team or a third -party verifier to carry out the M&V for the installed technologies.

4.2 Working mechanism with Guaranteed Energy Savings Model

In the guaranteed energy savings model building owner shall approach the ESCO for installation of the energy efficient technologies. The ESCO will then survey the building and analyse the usage pattern of the building including parameters such as occupancy, power usage trends, floor area under usage, and seasonal variations in power usage for both the current and past scenarios. A baseline power usage will be calculated post analysis by the ESCO. The EE technologies to be installed and the savings that will be achieved post EE equipment installation will be communicated by the ESCO to the building owner. The ESCO provides a guaranteed savings clause under which it is liable to pay the building owner any difference in the guaranteed and the achieved savings. The ESCO, to balance its financial risk, can then contact the insurance company for an insurance against the guaranteed savings by ESCOs to the building owner. Third party verification can happen in following ways:

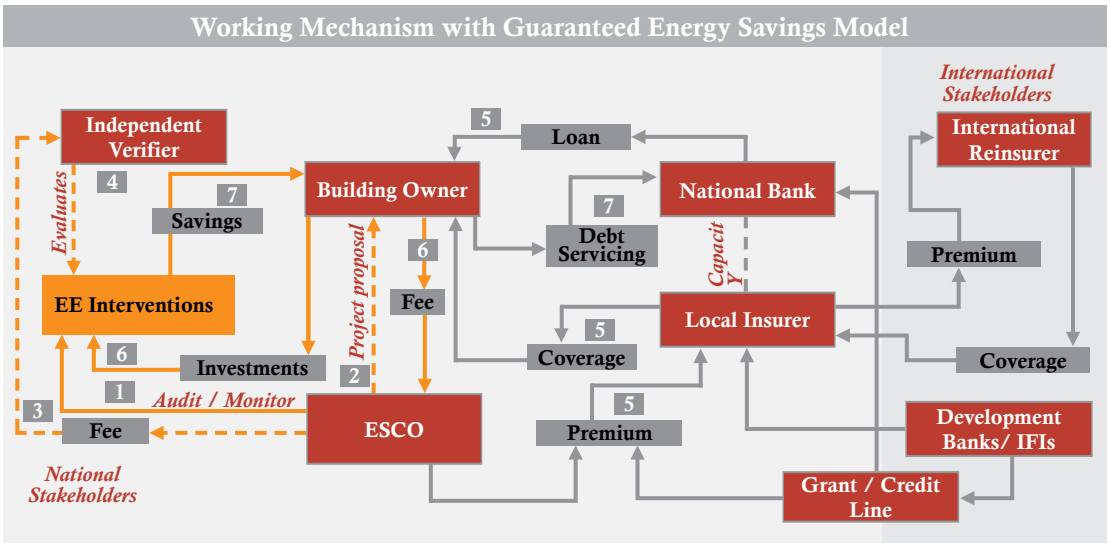
- **Through an Independent Verifier:** In this verification method ESCO can pay for the services of the verifier. Post receiving the insurance request from the ESCO along with the verifier report, insurance company will quote a premium to the ESCO after the going through the documents and doing site surveys.

- **Through in-house verifier of Insurance Companies:** Post receiving the insurance request from the ESCO, insurance company will conduct a third-party verification of the ESCO, guaranteed savings clause, baseline developed, and quotes a premium to the ESCO after the verification.

The ESCO can pay the premium up-front or on a periodic basis to insurance companies. Insurance company will pay any difference in the achieved and the guaranteed savings to the building owner based on the periodic reports by the ESCO and verification of the same through an independent or in-house verification team

Figure on next page describes the working mechanism with guaranteed energy savings model. Numbering on the figure shows the sequence of activities for the national stakeholders to get an insurance cover in the shared savings model. It is important to note that activities sequence may vary slightly depending upon the actual scenario and regulatory requirements that would be coming up because of the insurance product.

FIGURE 3: **Working Mechanism with Guaranteed Energy Savings Model**

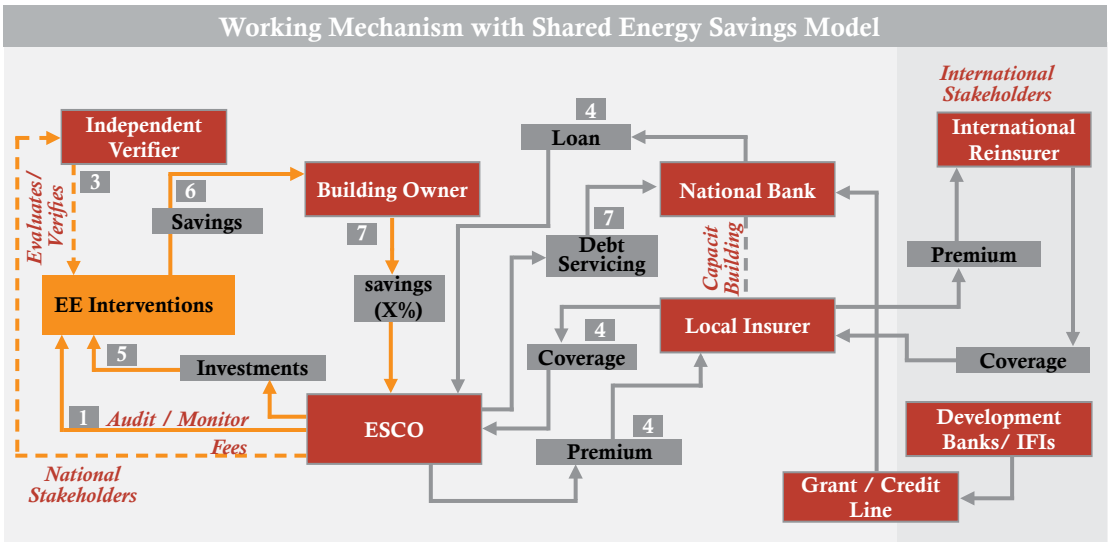


4.3 Working Mechanism with Shared Energy Savings Model

Working mechanism in this model will differ from the guaranteed model as the upfront investment for EE intervention will be provided by the ESCO. In this model building owner would be sharing a percentage of savings with the ESCO for an agreed length of time. Contract length will be dependent upon the mutually agreed terms and conditions between the ESCO and the building owner.

Figure below describes the working mechanism with shared energy savings model. Numbering on the figure shows the sequence of activities for the national stakeholders to get an insurance cover in the shared savings model. It is important to note that activities sequence may vary slightly depending upon the actual scenario and regulatory requirements that would be coming up because of the insurance product.

FIGURE 4: **Working Mechanism with Shared Energy Savings Model**



4.4 Risks to the EE insurance product and risk mitigation strategies

An energy efficiency insurance product insures the savings guaranteed by the ESCO to the building owner. The product deploys various mechanisms such as third-party technical verification, third-party project monitoring, insurance coverage, and re-insurer to minimize the risk involved. Various risks related to EE interventions can be divided into the following categories:

- Technical Performance Risks
- Financial Risk
- Legal Risk

An introduction of insurance product for India will mitigate the risks in the following manner

- **Technical risk mitigation:** The insurance company can deploy an independent/ third party technical verifier to validate different technical parameters of the project such as ESCO qualification, project design, proposed monitoring and verification scheme, technology installation etc. The third-party verifier is also responsible for the monitoring and verification of the project during operation. The verifier could be a technical body with experience in energy efficiency projects. The risk posed by the lack of technical competencies of the different stakeholders and the lack of confidence in the technical audit reports and the project proposal prepared is mitigated by the introduction of a third-party verifier.
- **Financial risk mitigation:** The financial risk assumed by the ESCO in the shared savings model is mitigated by the introduction of an insurance as it shifts the risk from ESCO's balance sheet. It also enables ESCOs with weaker balance sheets to enter into the market and execute capital intensive projects. The financial risk assumed by the ESCO / building owner in the guaranteed savings model is also reduced as the insurance company is liable to pay any deviation from the guaranteed energy savings rather than the ESCO. The insurance also puts the third-party lender at ease if debt capital has been raised.
- **Legal risk mitigation:** The risk of running into contractual disputes over achieved savings vs. guaranteed savings is mitigated by the introduction of a third-party verifier. The third-party verifier acts as a neutral body providing assurance to the stakeholders over the

technical sanctity of the project documents. The verifiers are responsible for the resolution of all disputes arising between the ESCO and the building owner. This decreases the time and funds required for dispute resolution.

Lastly, insurance company involved in the procedure also mitigates the risks posed to itself by engaging a reinsurance company.

4.5 Risks associated with selected energy efficiency interventions

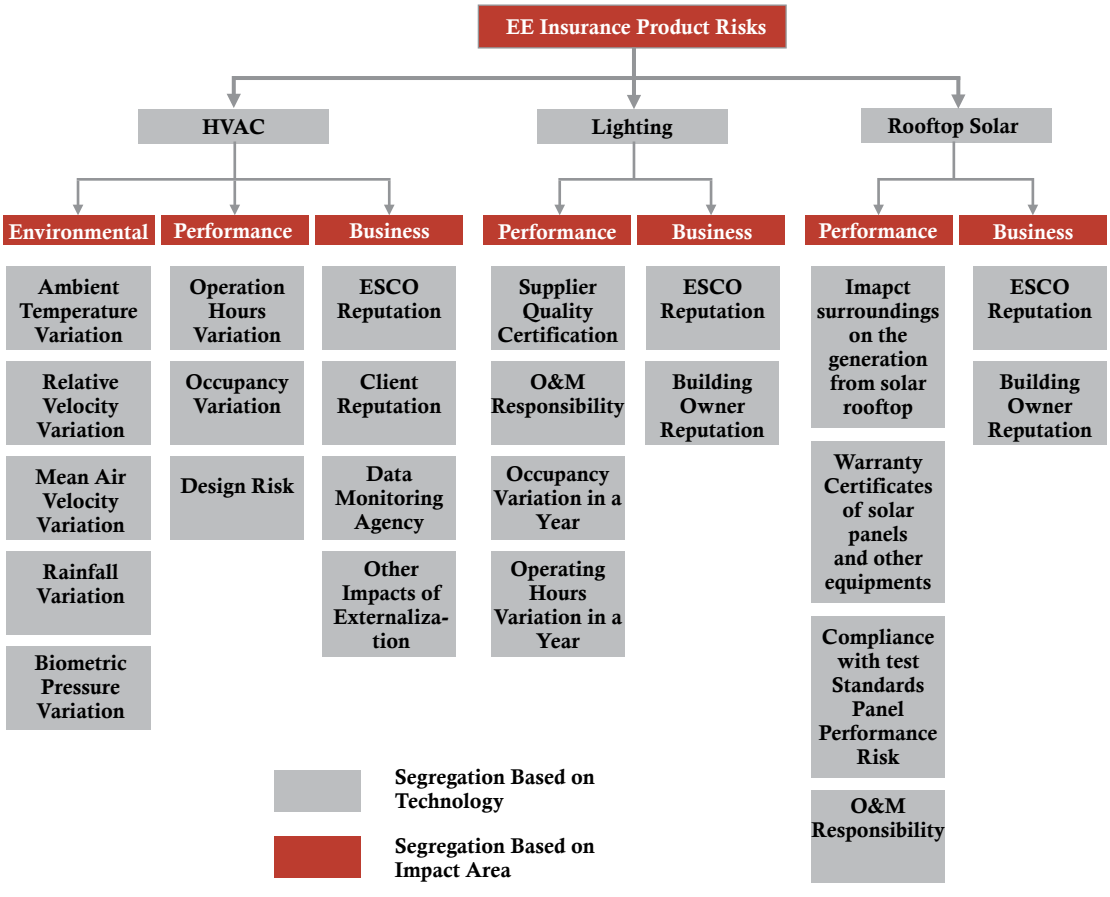
The risks associated with the three selected energy efficiency interventions are quantified based on secondary research and stakeholder interactions. An overview of the same is shown in the figure below.

4.5.1 Quantification of risks for HVAC technology

Based on the stakeholder consultation with ESCOs, building owners and equipment suppliers, HVAC risk factors can be broadly classified as; environmental, performance and business risks

Table below shows the various risk parameters and their quantification leading to high or low risk.

FIGURE 5: EE Insurance Product Risks



4.5.2 Quantification of risks for Lighting Technology

Lighting contributes to ~15-20% of energy consumption in commercial buildings. The risks for lighting technology have been categorized as; performance and business risks.

TABLE 3: Risk factor HVAC

RISK FACTOR : HVAC							
Risk Type	Parameter	VARIATION IN PARAMETER					
		LOW RISK			HIGH RISK		
ENVIRONMENT	Ambient Temperature Variation	0 degree C	0-5 degree C	5-10 degree C	10-15 degree C	15 – 20 degree C	>20 degree C
	Relative humidity variation	0	0-5%	5-10%	10-15%	15-20%	>20%
	Mean air velocity variation	0	0-3%	3-6%	6-9%	9-12%	>12%
	Rainfall variation	0	0-20%	20-40%	40-60%	60-80%	>80%
	Biometric pressure variation	<5%	5-10%	10-15%	15-20%	20-25%	>25%
PERFORMANCE	Operational hours variation	<10%	10-15%	15-20%	20-25%	25-30%	>30%
	Occupancy variation	<10%	10-20%	20-30%	30-40%	40-50%	>50%
HVAC DESIGN RISK	Step Operation of HVAC	4	5	6	1	2	3
	Reduction of blower power consumption through variable speed	20-25%	25-30%	>30%	<10%	10-15%	15-20%
	System's average annual efficiency	70-80%	80-90%	>90%	<50%	50-60%	60-70%
	Volume of air influx degradation	<5%	5-10%	10-15%	15-20%	20-25%	>25%
	Availability of buffer capacity	<5%	5-10%	10-15%	15-20%	20-25%	>25%
HVAC BUSINESS RISKS	ESCO Reputation	4	5	6	1	2	3
	No. of projects done by ESCO	5-7	7-9	>9	<1	1-3	3-5
	Client Reputation	4	5	6	1	2	3
	Data Monitoring Agency	Third party(agency with technical competence)			End user appointed agency	Third party(agency with technical competence)	ESCO appointed agency
	Other impact of externalities	If the rating falls greater than 1-2			If the rating falls within 3-4		

Table below shows the various risk parameters for lighting technology and their quantification leading to high or low risk.

TABLE 4: Risk Factor Lighting

RISK FACTOR : LIGHTING							
Risk Type	Risk parameter	VARIATION IN PARAMETER					
		LOW RISK			HIGH RISK		
PERFORMANCE	**Supplier Quality Certification**	Compliance of standards by lighting products			Non- compliance of standards by lighting product		
	O&M Responsibility	Third party (agency with technical competence)			End user or ESCO appointed agency		
	Occupancy variation in a year	<10%	10-15%	15-20%	20-25%	25-30%	>30%
	Operating hours variation in a year	<10%	10-15%	15-20%	20-25%	25-30%	>30%
BUSINESS	**ESCO Reputation**	5-7	7-9	>9	<1	1-3	3-5
	No. of projects done by ESCO	<1	1-3	3-5	5-7	7-9	>9

4.5.3 Quantification of risks due to rooftop solar PV technology

Risks due to adoption of rooftop solar PV technology have been categorized as; performance and business risks.

TABLE 5: Risk Factor for Rooftop Solar

RISK FACTOR : SOLAR ROOFTOP			
Risk Type	Risk parameter	VARIATION IN PARAMETER	
		LOW RISK	HIGH RISK
PERFORMANCE	**Impact of the surroundings on the generation from solar rooftop**	If no significant construction in last 2 years nearby to the building where solar panel will be installed or installed.	If evidences are there that significant construction is happening and can happen in the near future that can impact the electricity production from solar panels.
	Warranty Certificates of solar panels and other equipment	If warranty terms and conditions are similar to the terms and conditions provided by the lead manufacturer in a country.	If warranty terms and conditions are not similar to the terms and conditions provided by the lead manufacturer in a country.
	Compliance with test standards- Panel Performance Risk	If panel complies with the relevant standards.	If panel is not in compliance with the above mentioned relevant standards.
	O&M Responsibility	If the third party is appointed for maintenance of the system	If the end user or ESCO is involved in post maintenance of the system

RISK FACTOR : SOLAR ROOFTOP							
Risk Type	Risk parameter	VARIATION IN PARAMETER					
		LOW RISK			HIGH RISK		
BUSINESS	**Building Owners Credibility**	Credit rating assessment (if available). High and low risk can be categorized depending upon the rating of that company as compared to their peers.			Any default by owners in their business in last 2 years. Default in last 2 years on payment will mean high risk.		
	No. of years of ESCO operation	5-7	7-9	>9	<1	1-3	3-5
	No. of projects done by ESCO	5-7	7-9	>9	<1	1-3	3-5
	ESCO Reputation	4	5	6	1	2	3
	No. of projects done by ESCO	5-7	7-9	>9	<1	1-3	3-5

4.5.4 Project Risk Calculation Model

MS-Excel based model has been developed to evaluate the project risk impacting the energy savings due to adoption of EE interventions. Insurance companies can use this model to compare different projects on the basis of the total project risks. Project risk will also form basis to calculate insurance premium for a particular project.

Information Flow in the Model:

Model is built upon a sample cost – savings calculation for the selected intervention in the lighting area. Project risk has been considered as "0%" for the sample calculation on which model is built.

Various risk factors for the selected areas in buildings were identified through the stakeholder interactions. For project risk calculation through model, user will be required to select certain inputs on the basis of on-site scenario of energy consumption. User selection for every input will decide whether a particular factor/ parameter will become a low risk factor or a high risk factor. For each parameter becoming a "High Risk Factor", there is predefined variation (mentioned in assumptions) that would be in the factor that would be impacted because of the risk factor. For any risk factor, parameter that would be impacted will be either of the following:

- Savings from the intervention
- Cost of the intervention
- Cost and Savings

Risk percentage for any particular factor/ parameter has been calculated as:

Impact on Payback X Weightage of Parameter = Risk Percentage of Factor or Parameter

It is important to note that "Weightage of Parameter" has been kept as a variable in the model whose value depends upon the percentage impact on payback from a particular factor. Parameter that will have greater impact on the payback will also have higher weightage as compared to other parameters.

Total Project Risk = ∑ Risk Percentage of Factors

Replacement of CFL with LED fixtures (EE Intervention) has been selected to showcase the risk calculation methodology through a model.

Table 5 highlights the following:

- Factors/Parameters selected for the interventions
- Criteria for Low and High Risk for parameters
- Percentage impact on "Cost/Savings/Cost Savings" on the basis of user selection.

TABLE 6: Risk Calculation Model Assumptions and Input

Category	Parameter	User Selection	Risk Output on the Basis of User Selection	Parameter Impacted on the basis of user input	Percentage change on the Parameter Impacted
Supplier Quality Certification	Compliance with LED Standards	Yes	Low Risk	Cost	0%
		No	High Risk	Cost	5%
	LM80 Certification	Yes	Low Risk	Cost	0%
		No	High Risk	Cost	5%
Post implementation service	O&M Responsibility	ESCO	Low Risk	Savings	0%
		Building Owner	High Risk	Savings	-10%
ESCO Reputation	Crisil Grading	Grading 1	Low Risk	Savings	0%
		Grading 2	Low Risk	Savings	0%
		Grading 3	Low Risk	Savings	0%
		Grading 4, 5 and No Grading	High Risk	Savings	-10%
	No. of years of experience	> 5 Years	Low Risk	Savings	0%
		< 5 Years	High Risk	Savings	-5%
	Projects executed	More than 5	Low Risk	Savings	0%
		Less than 5	High Risk	Savings	-5%
Building Owner	Whether any default in last 2 years?	No default in last 2 years	Low Risk	Cost	0%
				Savings	0%
		Any default in last 2 years	High Risk	Cost	10%
				Savings	-10%
Electricity Tariff	Downward revision in state tariff in last 3 years	No	Low Risk	Savings	0%
		Yes	High Risk	Savings	-10%
Operating Hours	Variation in Operating Hours in an Year	Less than 10% in an year	Low Risk	Savings	0%
		More than 10% in an year	High Risk	Savings	-15%

4.6 Calculation of insurance premium

Objective:

Tentatively estimate base premium for an EE insurance project considering insurance companies' internal rate of return (IRR), tenure of the insurance contract, percentage of companies claiming for premium and respective project's aggregate risk rating.

Approach:

- Impact of risks impacting EE savings depends on the following parameters:
  - Monetary impact on savings for single occurrence
  - Probability of occurrence obtained from historical data
- As EE insurance industry is still in its nascent stage, historical data on the occurrence of risk factors is not readily available. Therefore, we considered only monetary impact on savings for single occurrence of risk factors and IRR of insurance companies to estimate tentative final premium for EE insurance product.
- Finally the base premium (calculated on the basis of insurance companies' IRR) is linked to the risk rating (aggregated risk score from all the risk factors identified) of the project to calculate the final premium.

Methodology:

- Base Premium calculation: Premiums paid to insurance companies are considered time bound (monthly/quarterly/half yearly/yearly) cash inflows for the firm where as payments towards insurance coverage are considered cash outflow for the firm.
- Coverage pay-out time is assumed at the mid of the premium tenure.
- Profitability of insurance companies based on the cash inflows and cash outflows has been captured through net present value concept and thus IRR has been taken as the input parameter for base premium calculation.
- The other assumptions are taken as :
- % of companies claiming premium out of all the companies opted for the risk insurance policy
- Tenure of the premium (5/10/15 years)
- Premium frequency/year (1/2/4/12)
- Risk insured/project
- The model works on the principle that NPV of future cash inflows and outflows are equal thus will take trial and error method to calculate the value for premium values (cash inflows) for which the above mentioned condition holds true.
- Base premium derived from the model finally has been linked to the aggregate risk rating of respective project to calculate the final premium.

4.6.1 Insurance premium calculation model

MS-Excel model has been prepared for calculation of the insurance premium based on the methodology outlined in the section above.

The following table summarizes the cell numbers and calculation methodology for the premium calculation.

TABLE 7: Assumptions/Input parameters

Assumptions/Input parameters:			
Serial No	**Parameters**	**Represented by cell no.(Refer to the premium model excel)**	**Rationale**
1	Internal Rate of Return (IRR) for Insurance Companies	H6	This parameter will judge profitability for the insurance company, as normal premium calculation methodology is not applicable for the case(Due to unavailability of historical data to assess probabilistic occurrence)
2	Risk Insured/ project	H7	This parameter will help determine the cash outflow (risk coverage) for the insurance companies.
3	% of companies claiming for coverage	H10	This parameter will aggregate total time bound cash inflows for the insurance companies.
4	Tenure of the insurance contract	R1, a drop down list is given to select 5,10,15,20,25	This value will determine total number of premiums, thus giving cash inflow timeline for the insurance companies.
5	Premium frequency/year	R2, a drop down list is given to select 1,2,4,12	This value will determine total number of premiums, thus giving cash inflow timeline for the insurance companies

The various output parameters calculated by the model are listed in the table below

TABLE 8: Output Parameters

Output Parameters			
Serial No	**Para-meters**	**Represented by cell no(Refer to the premium model excel)**	**Calculation methodology**
Base Premium	Base Premium	T1:T4	Cash outflow has been taken exactly at the mid of the insurance tenure and cash inflow has been taken based on premium frequency/year and a reference start date has been taken as 01-01-2016. Based on the input IRR, NPV of cash outflows and inflows calculated and the final NPV is calculated based on the % of companies claiming for premium. To compute base premium, final NPV has been made 0, 'Goal seek' tool is used to calculate the base premium.
Final Premium	Final Premium	X1:X4	Based on the risk factor calculated in the lighting model, premium charges imposed on the base premium.
Premium Schedule	Premium Schedule	Monthly: S7 Quarterly: S12 Half yearly: S18 Annually: S24	Based on the tenure of contract and premium frequency, premium schedule computed.

5 Launching EE insurance product in India

Insurance can be defined as an agreement between the insurer and the insured, where the insurer provides an "insurance cover" to compensate the insured for a damage/loss/death in return for an "insurance premium" paid by the insured. The insurance products can be classified as life and general insurance products depending on whether the product covers the life-risk of the insured or not.

The insurance business in India is regulated by Insurance Regulatory and Development Authority of India (IRDAI). IRDAI is responsible for governing the licensing and functioning of insurers and protect the interests of the policyholders. IRDAI has issued guidelines for launching new insurance products in India. Since the proposed EE insurance product will fall under the category of general insurance products, the guidelines for launching new general insurance products will be discussed in this chapter.

IRDAI has provided revised guidelines for filing new products in the general insurance category which came into effect from 1st of April 2016. As per the guidelines based on "who buys the product", the insurer has to classify the product as retail or commercial. A retail product can be sold to individual customers and their families. While a commercial product can be sold to entities other than individuals. The insurer can sell the retail product to commercial customers depending on the merit of the product, but vice-versa selling of commercial product to retail customer is not allowed.

The guidelines mandate that before filling of a new product, following pre-requisites have to be met by the insurer:

- **Underwriting policy:** The underwriting policy of the insurer should cover the underwriting philosophy adopted, the product design, rates, terms and condition of the use. In addition, it should provide a list of the activities of the insurer's Project Management Committee (PMC) and delegation of underwriting responsibilities. It should list out the procedure for risk identification, inspection and accounting. Furthermore, the procedures for auditing the quality of underwriting and adherence to the approved underwriting policy should be clearly mentioned.
- **Product Management Committee:** The insurer should setup a PMC consisting of high level officials of the insurer to ensure quality product design, filing with complete compliance of regulatory requirements and performance review.[9]

Procedures for launching insurance products:

- **File and Use:** The revised guidelines discussed above imply the final written confirmation of the product and allotment of Unique Identification Number (UIN) as well .The main emphasis is laid on establishing timely procedures. Commercial products must be filed under the File and Use procedure under which Procedure Management Committee plays a vital role. Once the product is contemplated and recommended by the procedure management committee and accepted by the insurer, the product document gets uploaded onto the IRDAI's website and a UIN is allotted. The insurer can market the product after the procedure discussed

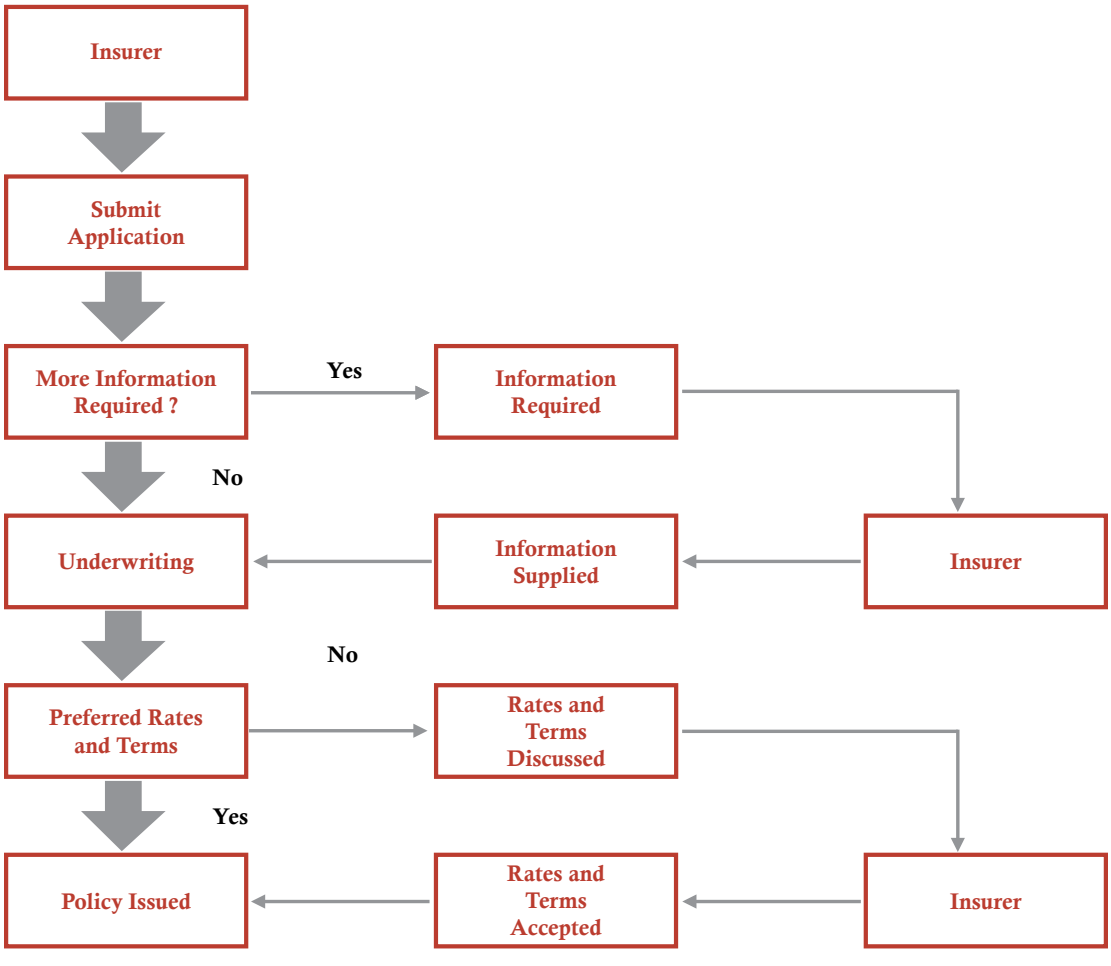
[9]Refer Appendix A for composition of the Project Management Committee

above. However, according to the revised guidelines the IRDAI holds full capacity to do a in depth check of the documentation and if it finds that the product is not in the interests of the policyholders or in conformance with the regulations, it may direct that the product be suspended, withdrawn or even filed under the file and use procedure.

- **Use and File:** The Procedure Management Committee is majorly involved in this procedure as it is a self-governing process. All the commercial products shall fall under Use and File procedure of general insurance. There are certain conditions which the insurer has to follow in order to market their product under Use and File procedure. These are listed below;
  - The product is reviewed and recommended to the insurer by the Product Management Committee only if there are no exception in the underwritten policy of the board.
  - The Appointed Actuary shall be responsible for reserving these products which the PMC will consider while approving the pricing of the products.
  - The insurer shall accept the recommendations and improvements on product design given by PMC.
  - All the required documents shall be uploaded online in Authority's Web system. Also it is important that the insurer is having a Unique Identification Number (UIN) number prior to marketing of the product.

Figure below depicts various steps from submitting of insurance product application by the Insurer to IRDAI to issue of the product to the end-user.

FIGURE 6: **Process Flow Chart for Insurance Product Application**



- **Timelines of Filing Insurance under "File and Use":**
  - The Authority shall get appropriate time to review the product filings submitted by the Insurer.
  - A response whether a query or a concern regarding the product documentation shall reach the insurer within a period of 30 days.
  - In case no action is reverted back to the insurer in this due time then a written letter can be submitted to the Authority within 30 days after the end of initial 30 days period for issuing of UIN for marketing the product. The Authority may extend the period from 30 days to another 15 days that is 45 days in total. If the Authority is unable to respond within this extended period then the insurer can submit another written letter within 30 days after the end of 45 days to consider it as a deemed noted product and for the allotment of UIN for marketing of the product.
- **Documents required for File and Use and Use and File procedures:**
  - Statement filing particulars of the product in Form A;
  - Certificate by the Chief Executive Officer in Form B;
  - Certificate by Appointed Actuary in Form C;
  - Certificate by the lawyer in Form D;
  - Internal product approval certification by PMC in Form E
  - Copy of Prospectus
  - Customer Information Sheet and other sales literature relating to the product
  - Copy of Proposal Form
  - Rate Chart with discount and Loading features
  - Technical Note duly signed by the Appointed Actuary
  - Copy of Policy/add-on wordings and copies of the standard
  - endorsements to be used with the policy; and
  - Copy of the Underwriter's Manual in respect of the product along with the list of declined risks, if any.
  - Claim manual
  - Claim Form
  - Any other support document relevant for the nature of product.
    - ✓ The form D shall be certified by a lawyer who is domiciled in India fulfilling the following requirements
    - ✓ A lawyer of a reputed law firm having minimum three years of experience in Indian Insurance or Legal Services.
    - ✓ A lawyer with experience of Indian Insurance procedures and well versed with all insurance policy wordings.
  - The insurer shall make sure that the documents of the product to be marketed carry their name and the name of the product on every page of the document.

Since the proposed EE insurance product will be the first of its kind in the Indian insurance market, it is recommended that the insurance company willing to launch this product adopts the "Use-and-File" procedure. In addition, due to limitation of data on various aspects of the EE insurance product such as deviation in actual and estimated electricity bill savings and impact of various risk factors on performance of the EE technology, the product should be categorized as a "Pilot product"[10].

[10]As per Schedule 1 of the "Guidelines on 'Product filing procedures for General Insurance Products'" released by IRDAI in February 2016, Pilot products are those products which are "launched by insurers to experiment marketing a new product concept for a short period of time in a defined pilot area with defined exposure limits."

Appendix A- Composition and role of the PMC members

Role of Product Management Committee Members[11]

The role of the following designates are only indicative in nature and are not limited to as specified.

1. Appointed Actuary

(a) Due diligence must be carried out on the product development process and pricing in accordance with regulatory stipulations in force.

(b) Documentation of assumptions and their basis for product pricing.

(c) Analysis of the financial implications of risks covered in the product and building these into the rating of product on sound and prudent actuarial basis

(d) Experience of the insurer in respect of commission, management expenses, contingencies and profit shall be consistent with the margins built into rates.

(e) Analysis of impact raised on the capital and solvency margin of insurer by the product. In order to maintain solvency margin inform the management and board of additional capital requirement, if any.

(f) Empowering the company to analyse the emerging experience of the product on a regular basis, informing the PMC about the data and system requirements at the time of underwriting and claims.

(g) Presenting a performance report to PMC incorporating recommendations at least on annual basis.

(h) Ensuring the availability of sufficient Actuarial resources in respect of products filing with the Authority

(i) Completion of Form A, allocation of Form C and Technical Note

(j) Submission of Product Performance report to the Authority in respect of every product/add-ons on annual basis (Financial year) not later than 30th June in respect of a preceding FY.

2. Chief Underwriting Officer

(a) Scrutinizing the language for describing the same cover or the same requirement of all the products in the company.

(b) Examining of the product with respect to the Underwriting policy of the company which is relevant in the context of evolving regulatory regime and market complexities.

(c) Conforming that the product and its features satisfy all the Basic principles of insurance.

(d) The terms and conditions of cover are fair between the insurer and the insured Conformation of clearance of the contingencies covered by the product and impartiality between the insurer and the insured with respect to the terms and conditions.

(e) Genuineness of the insurance product covering an insurable risk with a real risk transfer.

[11]The role of the PMC members are indicative only

(f) Simplified and easily understandable literature relating to the product for the public.

(g) Ensuring the involvement of the Company`s Lawyer for the purpose of Policy wordings.

3. Chief Financial Officer

(a) The commissions built in the product shall be in line with regulatory stipulations and actual commissions paid shall not exceed those allowed

(b) Confirmation for the product premium accounting and coordination of claims with Indian GAAP/regulatory stipulations

(c) Providing information to PMC about the tax implications of the product, if any

(d) Coordination with AA in identifying the additional capital requirements that the product may pose.

4. Chief Marketing Officer

(a) Identification of the target segments to which the product would be offered

(b) Indication of the business that the company plans to achieve in the next three years

(c) Conformation regarding the distribution of the product

(d) Verification of training of all the external distributors and company direct sales staff involved in the product and sales process.

(e) Appropriate systems to avoid and minimize sales that do not match costumer requirements.

(f) Presentation of periodic report to PMC on cancellations due to product sales not matching with customer need and action plan to reduce the cancellations.

5. Chief Risk Officer

(a) Integration of company's risk management framework and the risks arising out of the proposed product.

(b) Coordination with Appointed Actuary, Chief Underwriter and other product

(c) Stakeholders in the company to identify and assess non insurance and residual risks quantify these risks recommend an effective mechanism to minimize these risks to the PMC.

6. Head Reinsurance

(a) Reduction of overall risks due to the product and assessment of reinsurance requirement for the product from risk perspective.

(b) Ensuring reinsurance cessions and Reinsurance Regulations linkage and any other guideline/circular/direction issued by the Authority on the subject of reinsurance

(c) Identification of uncovered risks by reinsurance and retainment of these risks on book provided by the company. Analysis of such risks and notifying the PMC of financial implication regarding the same.

7. Compliance Officer

(a) Monitoring the overall product development process.

(b) Identification of the violations made by the product in any of the applicable laws,

Regulations and extant guidelines, circulars and directions.

(c) Supervising the business activities of the insurer and ensuring compliance between the products offered with the underwriting policy and certain guidelines related to them.

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