4.7 GREEN COMPLIANCE: PROTOCOLS, STANDARDS AND AUDITS

Successful Green enterprise transformation (GET) should result in a carbon-compliant organization. The organization should understand, measure, and Report its carbon performance according to the regulatory requirements of the carbon legislations in that region. Measuring, Reporting and validating the reports are crucial part for carbon compliance. Formal and informal audits of the carbon measures and reports are part of the governance for a responsible green organization. Meters and other recording devices, carbon-content databases, applications, and systems, used in producing the compliance reports and the accuracy of external green web services embedded in the applications should be formally audited. Carbon Emissions Management Software (CEMS) is developed for managing carbon performance of the organization. Various countries and regions interpret the need to reduce carbon differently. This variation is based on a number of factors such as the physical location, demographics, political will of the

government, public opinion, economic and social development of the region, and the state of the industry.

4.7.1 Protocols and Standards

United Nations Framework Convention on Climate Change (UNFCCC, Rio)

The UN Framework Convention on Climate Change (UNFCCC) is an intergovernmental treaty developed to address the problem of climate change.

The Convention, which sets out an agreed framework for dealing with the issue, was negotiated from February 1991 to May 1992 and opened for signature at the June 1992 UN Conference on Environment and Development (UNCED) — also known as the Rio Earth Summit.

The UNFCCC entered into force on 21 March 1994, **ninety days after the 50th country's** ratification **had** been received. By December 2007, it had been ratified by 192 countries.

The UNFCCC sets out a framework for action aimed at stabilizing atmospheric concentrations of greenhouse **gases to avoid —dangerous anthropogenic interference‖** with the climate system.

Controlled gases include methane, nitrous oxide and, in particular, carbon dioxide.

Kyoto Protocol

In light of increasing scientific evidence about the risks of climate change, it soon became evident to policy

makers that a further negotiated agreement might be necessary.

In December 1997, delegates at COP 3 in Kyoto, Japan, agreed to a Protocol to the UNFCCC that commits developed countries and countries in transition to a market economy to achieve quantified emission reduction targets.

These countries, known under the UNFCCC as Annex I parties, agreed to reduce their overall emissions of six greenhouse gases by an average of 5% below 1990 levels between 2008-2012 (the first commitment period), with specific targets varying from country to country.

The Protocol also established three flexible mechanisms to assist Annex I parties in meeting their national targets cost-effectively:

an emissions trading system; joint implementation (JI) of emission reduction projects between Annex I parties

Clean Development Mechanism (CDM), which allows for emission reduction projects to be implemented in non-Annex I parties (developing countries).

Following COP 3, parties began negotiating many of the rules and operational details governing how countries will implement and measure their emission reductions.

To date, the Kyoto Protocol has been ratified by 177 countries, including Annex I parties representing 63.7% of Annex I greenhouse gas emissions in 1990.

The Kyoto Protocol entered into force on 16 February 2005.

Green House Gas protocol

The Greenhouse Gas Protocol (GHGP) provides accounting and reporting standards, sector guidance, calculation tools, and trainings for business and government.

It establishes a comprehensive, global, standardized framework for measuring and managing emissions from private and public sector operations, value chains, products, cities, and policies.

The GHG Protocol also provides webinar, e-learning and in-person training and capacity-building support on its standards and tools.

In addition, GHG Protocol offers companies and **organizations the opportunity to apply for our —Built on GHG Protocol‖ mark that recognizes sector guidance,** product rules, or tools that are in conformance with GHG Protocol Standards.

GHG classifies emissions into three separate Scopes (1, 2, and 3) from which a basis for calculating the **organization's overall carbon footprint can be** established (see OSCAR for details of calculations):

Scope 1 emissions—The direct emission of GHGs by the organization.

Scope 2 emissions—emissions form the indirect consumption of energy such as electricity.

Scope 3 emissions—emissions embedded in the supply chain of the organization—primarily belonging to the business partners.

Copenhagen protocol

The Copenhagen Climate Change Conference raised climate change policy to the highest political level. Close to 115 world leaders attended the high-level segment, making it one of the largest gatherings of world leaders ever outside

UN headquarters in New York. More than 40,000 people, representing governments, nongovernmental organizations, intergovernmental organizations, faith-based organizations, media and UN agencies applied for accreditation.

It significantly advanced the negotiations on the infrastructure needed for effective global climate change cooperation, including improvements to the Clean Development Mechanism of the Kyoto Protocol.

Significant progress was made in narrowing down options and clarifying choices needed to be made on key issues later on in the negotiations.

It produced the Copenhagen Accord, which expressed clear a political intent to constrain carbon and respond to climate change, in both the short and long term

The Copenhagen Accord contained several key elements on which there was strong convergence of the views of governments.

This included the long-term goal of limiting the maximum global average temperature increase to no more than 2 degrees Celsius above pre-industrial levels, subject to a review in 2015.

Developed countries' promises to fund actions to reduce greenhouse gas emissions and to adapt to the inevitable effects of climate change in developing countries..

Agreement on the measurement, reporting and verification of developing country actions, including a reference to "international consultation and analysis", which had yet to be defined.

4.7.2 The ISO 14000:2004 a Family of STANDARDS

The primary objective of the ISO 14000 series of standards is to promote effective environmental management systems in organizations. The standards seek to provide cost-effective tools that make use of best practices for organizing and applying information about environmental management. The ISO 14000 family was developed in response to a recognized industry need for standardization. With different organizational approaches to environmental management, comparisons of systems and collaboration had proved difficult

ISO 14001

ISO 14001 standards are part of a family of standards (ISO 14000) designed to promote and guide an environmental management approach. It is appropriate for any kind of organization (company, NGOs, union, etc) concerned about improving its system of production, management, and operations as a way to better control its environmental impacts.

ISO 140001 has 2 main objectives:

To give a standardized and proven framework that can help organizations to develop an effective environmental management strategy;

To work as an official recognition and prize for the **organizations' efforts to improve their environmental** strategies.

The application of ISO 14001 is not a legal obligation and like all standards set by ISO, adopting it is voluntary. Nevertheless, despite not being mandatory, it imposes a compliance commitment with the current environmental regulation and its future developments for those who follow it. The basic principle of ISO norms is the search for continuous improvement, in successive cycles, according to the four-step process of the Deming (PDCA) cycle:

Plan

Do

Study/Check

Act

Following the steps of the cycle PDCA mentioned above, the implementation of the ISO 14001 standards is carried out in three stages:

At first, there is the need to audit the current organizational practices regarding environmental management and their compliance or non-compliance with the regulations and objectives of the ISO 14001 standards.

This will allow organizations to identify and have a clear picture of their procedures, making it easier to re-think and transform them in order to achieve the necessary improvements required by the ISO 14001 standards.

This self-audit can be done internally before-hand, but **all the information about the organization's** environmental procedures and policies will have to be endorsed to the certification entity and confirmed by its consultants.

Once the inventory has been completed, a program of measures to be taken and actions to be developed (prerequisites needed for the certification) need to be established and implemented according to an appropriate schedule.

Finally, a rigorous evaluation of the new practices and their environmental impact will be carried out regularly (an annual audit within every three years), where updates **or changes on the organizations' environmental** management systems may be requested.

ISO 14001 standards are above all a management tool.

As such, they do not impose certified organizations to achieve certain environmental objectives. Instead, ISO 14001 demands certificated organizations to have a system of procedures that must be respected in order to manage their environmental impacts.

An ISO 14001 certified organization is not necessarily an ecological one, what it means is that it has a system that allows it to improve on its environmental issues.

USA Energy Star

ENERGY STAR is a federal voluntary program run by the U.S. Environmental Protection Agency (EPA) to help people learn more about the many ways they can save money and help reduce environmental degradation through improved energy efficiency. Under the program the EPA identifies and promotes energy-efficient products and buildings, all with the overall goal of reducing energy consumption, improving energy security and reducing pollution.

One of the major sources of pollution is the formation of greenhouse gases. According to ENERGY STAR, two thirds of greenhouse gas (GHG) emissions in the U.S. come from energy use in homes, buildings and industry. Lowering the amount of greenhouse gases that go into the environment, then, has been a primary focus of the ENERGY STAR program and its ENERGY STAR rating system

A critical part of ENERGY STAR is its ENERGY STAR rating system, which focuses on three main areas: products, homes (new and existing) and commercial businesses. Getting an ENERGY STAR rating — which not every appliance has — means that a product meets certain federally mandated guidelines regarding energy efficiency. The guidelines vary depending on the product. The water requirements for a dishwasher to get an ENERGY STAR rating are different than for a washing machine. The EPA establishes its product specifications based on certain guiding principles:

Product categories must contribute significant energy savings nationwide.

Certified products must deliver the features and performance demanded by consumers, in addition to increased energy efficiency.

If the certified product costs more than a conventional, less-efficient counterpart, purchasers will recover their investment in increased energy efficiency through utility bill savings, within a reasonable period of time.

Energy efficiency can be achieved through broadly available, non-proprietary technologies offered by more than one manufacturer.

Product energy consumption and performance can be measured and verified with testing.

Labeling would effectively differentiate products and be visible for purchasers.

EPEAT—Electronic Product Environmental Assessment Tool

The Electronic Product Environmental Assessment Tool (EPEAT) is a global ecolabel for the IT sector. EPEAT helps purchasers, manufacturers, resellers, and others buy and sell environmentally preferable electronic products.

The EPEAT program provides independent verification of **manufacturers'** claims and the EPEAT online Registry lists sustainable products from a broader range of manufacturers than any comparable eco label.

National governments, including the United States, and thousands of private and public institutional purchasers

around the world use EPEAT as part of their sustainable procurement decisions.

The Green Electronics Council (GEC) manages this flagship program, including ensuring the integrity of the EPEAT system.

EPEAT is one example of how GEC supports institutional purchasers around the world, fostering a market for sustainable IT products to achieve our mission of a world of only sustainable IT.

Purchasers can search for electronics based on product category, manufacturer, geography or EPEAT rating.

EPEAT-registered products can even be identified based on specific attributes valued by an organization (reduction of toxic materials, recyclability, use of recycled plastic, etc.).

Manufacturers register products in EPEAT based on the **devices'** ability to meet certain required and optional criteria that address the full product lifecycle, from design and production to energy use and recycling.

Bronze-rated products meet all of the required criteria in their category.

Silver-rated products meet all of the required criteria and at least 50% of the optional criteria, while Gold-rated products meet all of the required criteria and at least 75% of the optional criteria.

Manufacturers' claims of compliance are subject to ongoing verification by qualified conformity assurance bodies.

Products claims found non-conformant are announced publicly and removed from EPEAT to ensure Purchasers worldwide can use the system with confidence.

- Implementing EPEAT contract **language also gives purchasers a vehicle for requiring suppliers to document all EPEAT-registered products purchased through that contract during a given year.**

This data, if shared with the Green Electronics Council, qualifies the purchaser for annual recognition and can be used to calculate the **purchaser's** specific financial and environmental benefits.

EPEAT-registered products meet strict environmental criteria that address the full product lifecycle, from energy conservation and toxic materials to product longevity and end-of-life management. EPEAT-registered products offer a reduced environmental impact across their lifecycles.

Over their lifetime, the 1.34 billion EPEAT-registered electronics purchased globally since 2006 will deliver significant environmental benefits.

Compared to products not meeting EPEAT criteria, these electronics will result in the reduction of 184 million metric tons of greenhouse gasses, elimination of 830,311 metric tons of hazardous waste, and will reduce solid waste by the equivalen**t of 528,098 U.S. households'** annual waste.

EU RoHS—Restriction of Hazardous Substances Regulations

This restricts the use of six hazardous materials found in electrical and electronic products. All applicable products in the EU market since July 1, 2006 must pass RoHS compliance.

Directive 2011/65/EU was published in 2011 by the EU, which is known as RoHS-Recast or RoHS 2.

RoHS 2 includes a **CE-marking directive**, with RoHS compliance now being required for CE (Carbon Emission) marking of products. RoHS 2 also added Categories 8 and 9, and has additional compliance recordkeeping requirements.

Directive 2015/863 is known as RoHS 3.

Any business that sells applicable electrical or electronic products, equipment, sub-assemblies, cables, components, or spare parts directly to RoHS-directed countries, or sells to resellers, distributors or integrators that in turn sell products to these countries, is impacted if they utilize any of the restricted 10 substances.

With the rapid spread of digitization, the world's production of electrical and electronic devices is exploding.

Besides mobile devices, think about the coming wave of IoT, smart home assistants, robots, drones, 3D printers, and home medical devices to all corners of the planet are regulated by RoHS.

EU WEEE—Waste Electrical and Electronic Equipment Regulations

The objective of the Directive is to promote re-use, recycling and other forms of recovery of waste electrical and electronic equipment (WEEE) in order to reduce the quantity of such waste to be disposed and to improve the environmental performance of the economic operators involved in the treatment of WEEE.

The WEEE Directive sets criteria for the collection, treatment and recovery of waste electrical and electronic equipment.

Waste of electrical and electronic equipment (WEEE) such as computers, TV-sets, fridges and cell phones is one the fastest growing waste streams in the EU, with some 9 million tonnes generated in 2005, and expected to grow to more than 12 million tonnes by 2020.

WEEE is a complex mixture of materials and components that because of their hazardous content, and if not properly managed, can cause major environmental and health problems.

Moreover, the production of modern electronics requires the use of scarce and expensive resources (e.g. around 10% of total gold worldwide is used for their production).

To improve the environmental management of WEEE and to contribute to a circular economy and enhance resource efficiency the improvement of collection,

treatment and recycling of electronics at the end of their life is essential.

To address these problems two pieces of legislation have been put in place:

The Directive on waste electrical and electronic equipment (WEEE Directive)

The Directive on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS Directive)

Green Grid—2007

The Green Grid is an affiliate membership level of the Information Technology Industry Council (ITI), a premier trade association that works to advance public policies for the tech sector.

ITI's Green Grid works to improve IT and data centre energy efficiency and eco-design around the world. It is an open industry consortium of information and communications technology (ICT) industry end-users, policymakers, technology providers, facility architects, and utility companies.

. The Green Grid works globally to create tools, provide technical expertise, and advocate for the optimization of energy and resource efficiency of Data Centre ecosystems which enables a low carbon economy.

The Green Grid was founded in 2007 with the collective viewpoint that energy efficiency in the data centre is one of the most significant issues facing technology providers and their customers.

This situation is not only due to exponential increases in power and cooling costs over the past few years, but also because customer demand for concentrated computing is outpacing the availability of clean reliable power in many places around the world.

The Green Grid is the first industry initiative chartered to take a holistic view of the ICT ecosystem, with a focus on addressing the pressing issues facing data centre users.

In 2019 TGG was acquired as an affiliate member of the Information Technology Industry Council (ITI), which is a premier trade association that works to advance public policies for the tech sector.

CSCI—Climate Savers Computing Initiative

The CSCI promotes the use of technologies such as power management features that both cut energy use when computers are not in use and improve power delivery efficiency.

Google and Intel founded CSGI in the U.S. as a nonprofit group of consumers, businesses and conservation groups aligned to reduce IT-related greenhouse gas emissions.

Consumer members of the initiative are asked to use energy efficient computers and enable power-management capabilities, such as sleep or hibernate mode.

Participating manufacturers agree to develop products that meet or surpass Energy Star standards, while

systems buyers commit to use power management features and choose Energy Star products in their procurement.

NGOs agree to educating end users on power management tools and the perks of energy efficiency.

4.7.3 Green IT Audits

Green IT audits are formal, independent verification and validation of the carbon performance and carbon reporting of the organization.

With increasing legislative demands on carbon reporting, these Green IT audits play a vital role in establishing the Green claims of the organization.

Auditing of CEMS is a part of these audits. Every carbon reporting and carbon related transaction will be audited through an independent module of the CEMS itself—that is owned and controlled by the auditors.

Internal and external audits have slightly different roles to play in terms of carbon emissions reporting.

Internally, they provide the confidence to the decision maker on her investment in the Green project, and externally, they provide the legal backing required of any formal reporting of data. Such audits, as part of the overall audits of an organization, provide systematic assessment of the organizations structures and operations.

Externally they provide legitimacy to the reporting and the claims to greening made by the organization.

Green audit assess a company's environmental credentials and its claim for green products and services.

Audits can also determine whether the compan**y's supply** chain and/or product line can be accepted as truly environmentally sustainable.

Green audits are very closely associated with metrics and measurements. Green audits primarily validate that whatever is being reported in terms of carbon emissions is accurate and sufficient. Green audits can

also suggest areas for improvements in the **organization's compliance with standards as well as** legislations.

Green audits can cover the regularity accuracy, calculations, analysis, reporting, and storage of carbon emission data. Such validated data analysis can ascertain the Green IT readiness and maturity of an organization, that of its corresponding industry and even at a global.

This need of businesses to have reliable carbon data need to be supported by new metrics and measurements that are being invented rapidly and standardized across the industry.

Audits prove the validity of concrete carbon measures

that enable comparison ,justification, and optimization of **an organization's green credentials.**

Everything that can be measured within Green IT is not **necessarily a good ―indicator‖ of the greenness of the**

organization. Furthermore, everything that needs to be measured is not necessarily easy to measure.

The challenges to these measures stem from the fact that currently many emissions get omitted, others get double calculated.

Green metrics

There are five areas of green metrics:

Measure: What is being measured? Is that measurement sufficient for reporting purposes?

Are there additional areas of carbon data that should be included in the measurements?

Monitor: What is the mechanism to collect the data? Where are the meters located?

Manage: Validate the feedback and management mechanisms of carbon data, information, and analysis. The carbon management, governance standards, processes, and controls are audited in this area.

Mitigate: Is the measurement and reporting of carbon data also being used to reduce the emissions?

What are the systems in place for carbon mitigation and how well they are operating? The audit in the area of mitigation will be mainly of interest to the internal stakeholders of the organization, but will have external effect.

Monetize: Audits of the monetizing aspects of carbon data will be of immense regulatory interests as the businesses move toward carbon economy. Ability to

trade carbon requires accuracy and authenticity of systems that enable that trade.

Advantages in undertaking Green IT audits within organizations:

Validation of entire organizations asset register from a carbon emissions perspective.

Formalization of metrics and associated measurements

Validation, internally of cost-benefit calculations that demonstrate the ROI on green initiatives to corporate governance board and the shareholders on indexing of carbon measures with financial performance of the organization.

Cross-check on smart meters used for automatic reading and display of carbon data.

Stocks take of the skill set, experience, and necessary expertise within the organization to put together a Green IT measurement and optimization program.

Ratifying the agreement among the organizations stakeholders as to what should and should not be included within carbon emission calculations.

Validation of the calculation on electronic waste and its disposal.

Adequacy of policies and practices in addressing the complete and comprehensive carbon footprint of an organization.

Being part of the value proposition for business through its green initiatives both internally and externally.

Assist in objectifying (making explicit) the other tacit attitude and viewpoints of participating employees and management in measuring the green credentials of the organization.

Reducing the confusion and, perhaps, duplication of calculations that may occur in a collaborating group of partners.

Provision of relative benchmarks from audit to audit.

Validating the measuring of degree of sophistication or maturity.

4.7.4 Types of Green Audit

Green metrics and measurements used for green audits purpose need to be validated themselves. Measurement systems must be developed that can establish baselines and measure carbon storage and emissions changes on various scales, from individual machines to large processes of the business. The advanced ICT technologies and techniques such as SOA, web services, mobile technologies, semantic networks, Cloud computing, Information Management Systems can play an important role in the development of monitoring and measuring emission tools. Mitigation deals with reducing the carbon footprints of a business by identifying ways of operating more efficiently and thus reducing the costs and CO2 emissions. Monetizing is poised to take advantage of the opportunity to trade carbon credits in future. The following are the collection and use of carbon data needs to be audited during green audits:

Data collection mechanisms and corresponding gadgets/meters.

Data analysis undertaken by software systems

Carbon trends: Plotting of the carbon trends, their accuracy and reliability

Carbon compliance: Both internal and external auditing parties are involved in ensuring that the organization is complying with the limits set for emissions by the regulatory bodies.

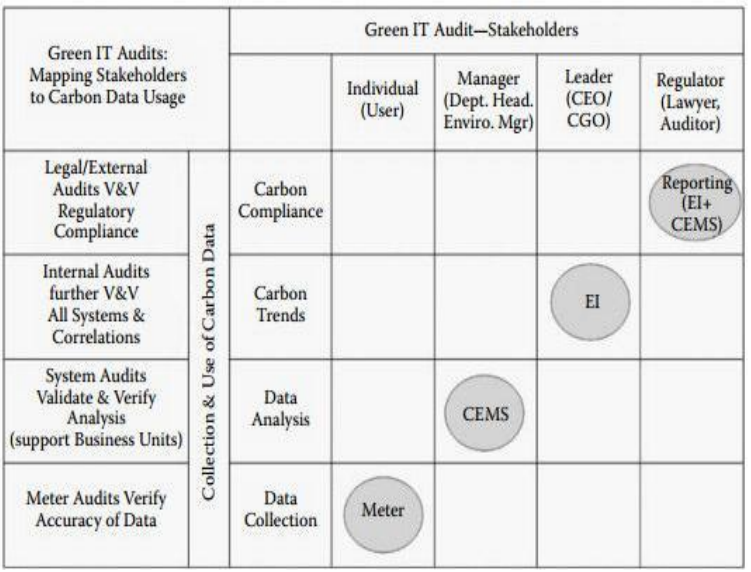

Fig 4.14: Various elements in Green audit

The stakeholders of green audit are as follows:

Individual users: provides input into the data collection mechanisms.

Departmental heads: involved in analysis provided by the software system (CEMS) dealing with carbon data. This analysis would show to a business unit or a

department clearly the amount of carbon generated by its activities as well as potential carbon savings.

CEO/chief green officer (CGO): interested in all aspects of the Green IT audits, but particularly in the environmental intelligence aspect of the organization.

Regulators: external parties that want to determine the accuracy and validity of carbon data reporting as undertaken by the organization.

4.7.5 Green IT Audits—Approach, Maturity, and Comparison

An integrated model for Green IT audits includes steps required in the audit, the various dimensions of an organization that need to be audited, ascertaining the Green IT maturity of the organization and the various areas. within the organization that will be audited.

Undertaking Green IT Audits

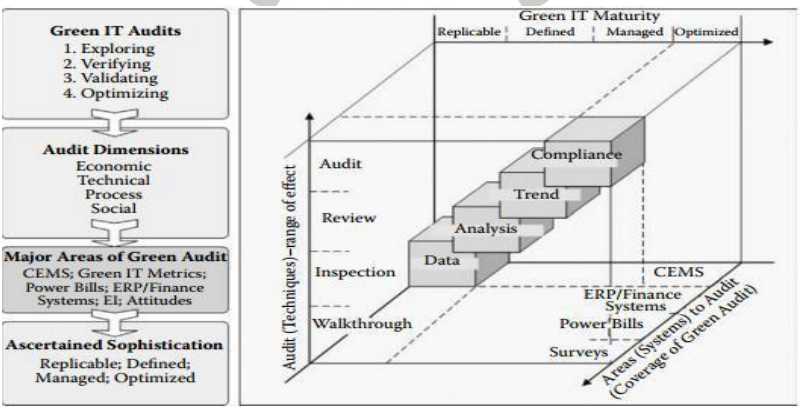

Fig 4.14 Integrated model for green IT systems

The core areas apply to the various systems, packages and surveys. The known quality techniques of walkthroughs, inspectors, reviews, and audits can be applied in undertaking audits. The following are the ways of conducting green audits:

Walkthroughs: Individually performed, to identify basic emissions data relating to an individual or a department. Walkthroughs can also be conducted of the CEMS algorithms that are used in calculating the emissions data.

Inspections: more rigorous than walkthroughs and are carried out by a person or party who is not the original producer of the artifact. Thus while the Green IT auditors will carry out the inspections, the staff responsible for smart meters and other gadgets used in collecting data, as well as those responsible for the processes for storing, reporting, and managing carbon data will provide the necessary information, and answer queries

Reviews: go beyond walkthroughs and inspections, and formally verify and validate a process. In the Green IT domain, reviews are conducted by both internal and

external auditors. Reviews would require preparation beforehand of the areas to be reviewed—such as systems, databases, equipment lifecycle, and wastage disposal processes. Reviews also encompass verification and validation of the accuracy and efficacy of the governance processes and methodologies, and also cover economic and social dimensions.

Audits: very formal, both internal and external to the organization. Green IT auditors will be invited or may enter the organization to conduct formal audits of the carbon data collection, analysis, and reporting. Audits cover all work areas and all four dimensions. Audits can make use of the aforementioned quality techniques of walkthroughs, inspections, and reviews. At the end of the auditing process, a formal report is prepared to present and discuss the outcomes. Whenever carbon benchmarks or limits are transgressed by the organization, they are pointed out by the auditors. Appropriate actions are also discussed and a plan to undertake them is highlighted during the audits.

4.7.6 Audit and Use of Carbon Emissions Management Software (CEMS)

A CEMS helps an organization manage its energy consumption by accurately recording, analyzing, and reporting on the carbon data. It is responsible for reduction and management of carbon emissions and help an organization meet its environmental goals.

Auditing a CEMS requires attention to the following:

Accuracy of the data captured by the system.

Security and ease of storage of carbon data.

Security and ease of retrieval

Validity of analysis and trend creation

Frequency and reliability reporting of emissions and related information

Ease and accuracy of updating environmental parameters that drive CEMS

Interfaces to the government regulatory portals using web services

Environmental compliance by vendors and other business partners

Use of CEMS in the audit function itself

Comparative Audits

Audits provide an organization with a feedback on its current performance as well as Green maturity. The results of audits will enable an organization to understand where it stands on the Green CMM. Audits can be conducted to ascertain the current state of an organization and plan for the future state. Reports on the results of a properly conducted Green IT audit will also enable an organization to understand its strong and weak areas, and thereby help it in its ongoing optimization effort by enabling selection of right projects within its transformation programs.