

## White Paper



# Towards Environmental Sustainability

## Environmental Resources Management

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### Abstract

Environmental resource tracking and managing in organizations is a fundamental step towards environmental sustainability. Organizations starting to work towards sustainability face the challenge of assessing what data to capture, how to capture data from disparate systems, what data to report, and how to convert the captured raw data to useful information. This paper talks about the need for managing environmental resources, provides the organization-level guidelines for managing the impact of environmental resource usage and discusses how dimensional data model can help measure and track usage of environmental resources.

## Introduction

*Environmental sustainability* in organizations is being mandated by various internal factors and external factors; internal factors such as resource efficiency, business opportunities and increasing social conscientiousness, and external factors, such as regulations, compliance requirements, competition, and customer expectations.

Measuring and tracking organization's environmental resource usage is a vital step for organizations to work towards environmental sustainability. Rising energy costs and dearth of environmental resources drive organizations to strive for efficient alternatives and optimal usage of available resources. Measuring and tracking environmental resources provides insights into usage patterns and helps in reducing operational cost and increasing efficiency.

A number of organizations are focusing on environmental sustainability, which, typically, is quite different from organization's core business. Organizations beginning on their sustainability journey need to identify the types of data to be measured, various activities required for managing the environmental data, different types of reporting activities required to monitor organizational-level the same. Organizations also need to know the key goals to be achieved and how to systemically achieve them.

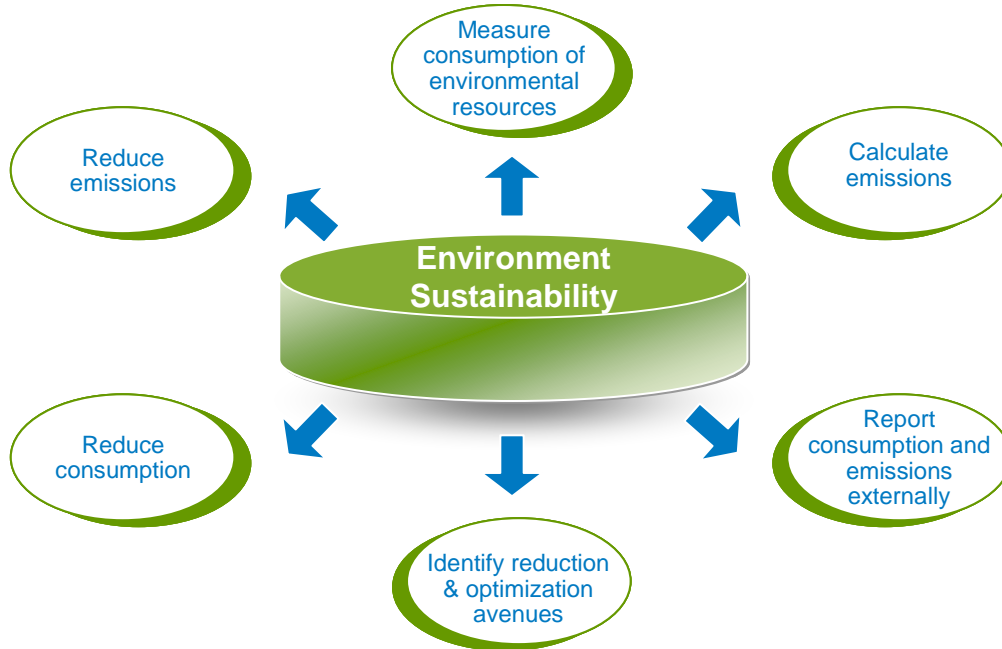
This paper provides organizational-level guidelines for measuring the impact of environmental resource usage in organizations' facilities, and discusses the data model to track and manage usage of environmental resources in facilities. This facilitates tracking, analysis, calculation of emissions, reporting and provides avenues for optimization of environmental resources in organizations.

## Key Goals

An organization's operations impact the environment by consuming depleting natural resources and by affecting the immediate environment due to air emissions, water discharges, and waste disposal. To assess their impact on environment, organizations have to measure consumption of natural resources and impact caused to environment, directly or indirectly, due to organizational activities. An organization's leading impact on the environment is the Green House Gas (GHG) emissions caused due to various organizational operations. Organizations need to track the consumption and emissions data to:

- Manage operational cost and emissions
- Identify reduction opportunities
- Report data for transparency and recognition
- Optimize usage of resources
- Report data for mandatory and voluntary programs like Global Reporting Initiative (GRI)
- Track and manage compliance to regulations

Figure 1: Environmental Sustainability Goals

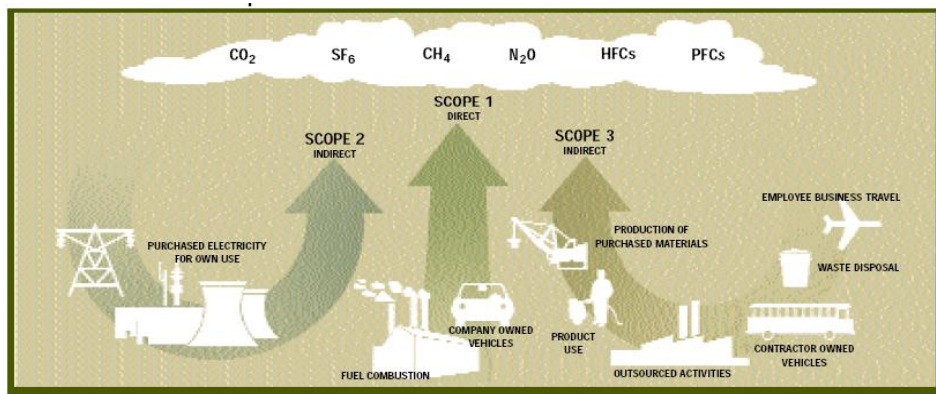


To achieve the above goals, organizations have to measure their impact on the environment, continuously monitor the performance through reports, and then analyze and manage it by setting reduction targets and optimization plans. This approach would help organizations isolate the challenges in gathering, managing, and tracking environmental data. Organizations that are beginning to focus on environmental sustainability have to establish data capture mechanisms across their operations in order to assess their current status. This can be very challenging as the data for various activities requires to be captured from disparate applications and sources within the organization.

After capturing the environmental data, organizations have to calculate emissions to know their impact on the environment. The below figure categorizes high-level company operations based on their emission scope and gives a view on the various emission-causing operations.

Figure 2: Organization operations and emissions

Source: GHGprotocol.org



Organizations need to continuously monitor their environmental performance to analyze areas of improvement and to report the captured data. Once organization knows its current state through measuring and monitoring its own data, it needs to manage the same by setting reduction targets and enhancing its performance. These steps are explained in detail in the following sections.

## Proposed Model for Environmental Sustainability in Facilities

We propose the 3M model of Measure, Monitor & Manage to achieve environmental sustainability. This model helps organizations to help approach environmental sustainability in a structured manner.

**Figure 3 – The 3M model**



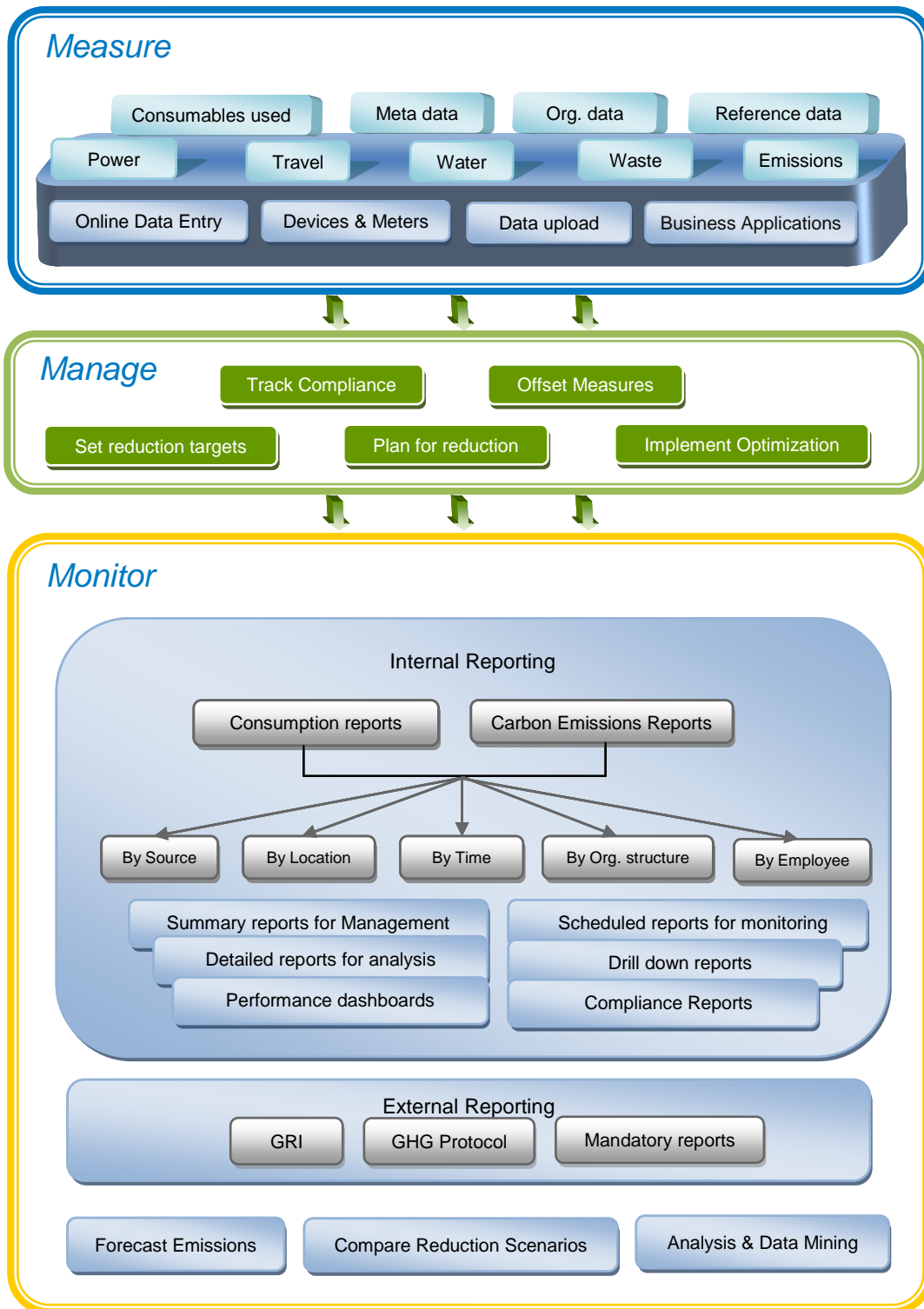
Organizations need to identify the types of data to be measured, various activities required for managing the environmental data, and different types of reporting activities required to monitor organizational-level environmental data. Organizations can achieve this with the help of technical solutions.

“*The Information Communication & Technology (ICT) industry is responsible for approximately 2% of global CO2 emissions. ICT solutions have the potential to be an enabler to reduce a significant part of the remaining 98% of total CO2 emitted by non-ICT industries.*”

Source: Gartner/HP/McKinsey/WWF

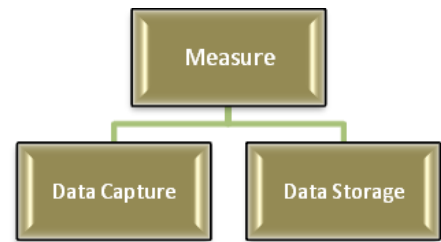
The figure below gives a snapshot on the various activities that Measure, Manage and Monitor constitute and provides a view on the conceptual model.

Figure 4 – The conceptual model



## Measure

Organizations have to measure the data to know their current position and to streamline the data collection continuously. Measure involves gathering data from disparate sources within and outside the organization and storing of the data in a format that would ease reporting and analysis.



### **Data Capture**

Data for internal use is required at the lowest granular level possible so that accountability, and in turn the responsibility, is established at lower levels in the organization structure and also for easier troubleshooting in the problem areas. It is complex to capture various activities at different hierarchies and data-granularity levels, and also compare their contribution at organization level. For example, business travel information is captured at employee level and mapped to the employee's location, unit/department, and time of travel. On the other hand, consumption of water has is captured at the building/water resource level and mapped to the location. Consumption-related data of various environment resources such as energy, water, transport, and paper is available in disparate applications and systems. This data may be dispersed across various media such as SAP, ERP, databases, spreadsheets, text files and so on from different resources. There is also a need to load reference data such as emission factors, energy density, Global Warming Potential (GWP) and so on to calculate emissions. This becomes increasingly difficult since data formats and storage media are organization-specific and also vary within an organization. Reporting and analyzing data directly from various systems is complex and cumbersome. The first step in this process is creating a data model that gathers consumption and reference data from various systems and formats.

### **Continuous Data Capture**

Data from various sources is captured and loaded to the data storage continuously. This requires daily data to be loaded into the storage as per a pre-defined schedule. This process should be planned to ensure incremental data loading.

Data collection can be done by users updating the data in the system, or by continuously loading the data into the system. The Extract Transform and Load (ETL) process enables automated movement of data from various sources into the data storage. This process stores data collected from various sources as Facts and Dimensions.

### **Facts (Measurable Data)**

Measurable data or Facts are data that needs to be measured. For example, values such as electricity consumption in kWh, water consumption, and distance travelled contribute to the measurable value. Whereas, the calculated values such as electricity consumption per person, emissions per person, and so on are stored as Facts.

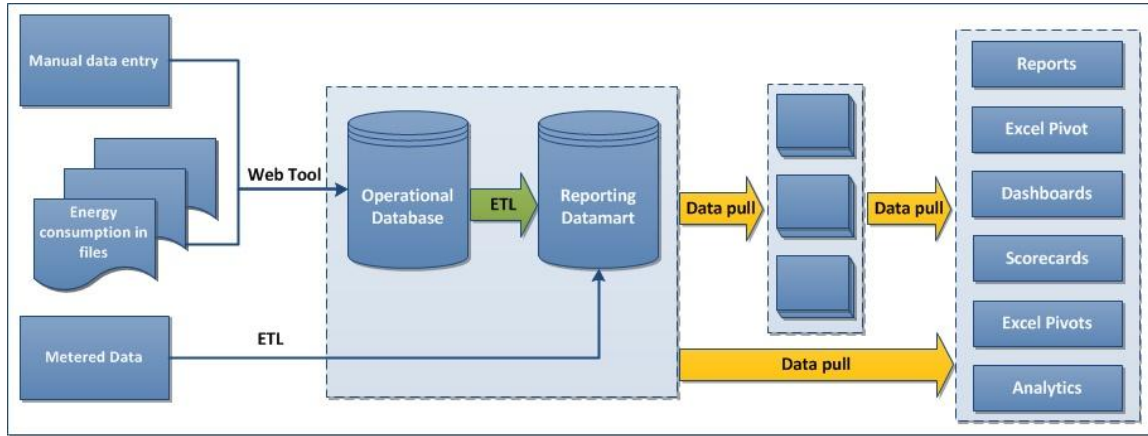
### **Dimensions (Data around which the measurable data is analyzed)**

After identifying measurable data, we have to decide on the basis for data analysis and reporting. This requires two types of data:

1. Essential data to capture such as location and time. This is the raw data for measurable data and is captured over a period of time. This data is available at the data capture point.
2. Additional parameters required to analyze data. These data are identified based on additional analysis requirements. For example, to analyze electricity consumption in building additional information such as building type, building orientation, number of people in the building, and so on is captured. These data are the additional parameters around which data can be analyzed and reported.

The continuous data capture process consists of another key activity of defining the hierarchy in various dimensions. This has to be carefully planned based on the reporting requirements. For example to capture the time dimension, the possible hierarchy is year, quarter, month, and day in that order.

**Figure 5 – Data collection model**



### Data Storage

The consumption data, metadata, organizational data, and reference data is collected from various sources through online data entry, data upload, or other business applications. This data should be stored in a format that makes continuous data loading, reporting, and analysis easier.

There are two data models to handle this:

- Operational data model: Operational data model is the master data store that acts as a single repository for all the data.
- Reporting data model: Reporting data model is a data mart that primarily serves the reporting and analytical needs.

### Operational Data Model

The Operational data model stores resource consumption data, metadata, and reference data such as emission factors and organizations (for example, units and buildings) in a single repository. It is used as a master data store that also supports online data entry, whenever required. It also provides users with online access to enter/modify the data and configuration details in the system.

Operational data provides the following functions to various users/applications:

- Administrators can upload/enter data
- Power analyst can feed master data
- Data can be captured from the application transactions
- Employees can enter their personal usage data
- Exceptions can be loaded into the system

This is a relational data model developed using the typical Entity Relationship(ER) modeling concepts. This data model is optimally normalized to handle transactions as well as bulk loads. This model allows users to update data during exceptions.

## **Reporting Data model (Data Warehouse)**

Reporting data model stores data for reporting and analysis, and is the main data store that stores sourced data. This data model is tuned for querying data, which can be used for reporting and analysis. This data model is designed to support Dimensions and Facts in order to align with the dimensional modeling concepts and be customized for reporting and analytics. The facts are the tables that store data measures, and dimensions are tables that are used for viewing the data by various business dimensions. The key elements in this model are the consumption data used in an organization such as electricity, water, waste, travel, and commute.

The dimensions are based on the organizations and their business divisions and departments. Some of the common dimensions are time, hour, location, division, units, and so on. This model is tuned for optimum performance as well as for reporting- and analysis-support. The data stored in this model can be aggregated by various dimensions.

## **Monitor**

Monitor involves reporting measured data for variety of needs and applying Business Intelligence & analytics to extract useful information from the measured data.

## **Reporting**

Reporting can be broadly classified into internal and external reporting based on their target group. Internal reports include organization-specific formats mainly focused on managing and optimizing resources. External reports like Global Reporting Initiative (GRI)\* mandate a specific format and structure for reporting, in order to facilitate comparison between organizations and verify organizational-compliance.

Internally, organizations require very specific data in order to analyze, and hence reports should be granular and detailed. For example, organizations reporting and analyzing energy consumption require energy consumption reports ordered by building, equipment, and meters that are monitored daily or hourly. This requires reporting to manage huge volumes of data. Managing volumes of data to make it flexible and easy to access requires a robust data model that can handle updates and perform efficiently.

This is can be easily achieved through the dimensional model. By using the dimensional model, reports based on multiple dimensions can be created quickly, since as all the aggregated data is already processed and stored in the cubes. Calculated values such as energy consumption per square feet are required for easier comparison of data. These values are pre-calculated and stored in the cubes.

Since data is stored in a reporting data model, both canned and interactive reports are easily available to the users. Canned reports are a set of reports that are created and viewed on-demand. Reports like viewing travel emissions by month, electricity usage for a division/department, and so on are categorized as canned reports. Interactive reports are a set of reports that provide user interaction in the reports. For example, a user views the report at a high level and can then drills down to details, if required. Users have the flexibility of selecting a report and drilling down to the details, or selecting a date range for the report. This feature is extensible to other fields such as city, month, country, project, and so on.

The data model also includes a customized set of set of reports that are specifically for the internal users. These reports are detailed and include advanced features such as:

- Scheduling of report delivery by email
- Exporting the reports to Excel, CSV, and PDF file formats
- Printing the report
- Creating comparison reports

Externally, compliance and voluntary reporting requirements mandate that organizations report aggregation of their consumption and emission, either quarterly or annually. Since dimension-related data is stored in the least granular-level possible, it is easily aggregated for the required interval, dimension, and format. For example, the quarterly report for the total energy consumed across the organization is generated easily by aggregating the consumption value in time dimension for the given period. Organizations need to be prepared to report in the various formats mandated by various standards. For example, for voluntary sustainability reporting the Global Reporting Initiative (GRI)\* has a specific reporting format in which organizations need to report its data.

*\*[The Global Reporting Initiative (GRI) is a network-based organization that has pioneered the development of the world's most widely used sustainability reporting framework and is committed to its continuous improvement and application worldwide. Refer ([www.globalreporting.org](http://www.globalreporting.org)) for more details].* The various mandatory emissions reporting have different formats and data aggregation methodologies that need to be accounted for and planned for during data capture.

## Data Analysis

Data, by itself, cannot provide any meaningful information to the organization. Organization should capture raw data along with various supporting parameters and metadata, to facilitate optimum analysis of data and accrual of useful inferences. Organizations should capture all related attributes and metadata for all activities so that it can be used in analysis.

For example, while capturing electricity consumption data of a building, it is important to capture building characteristics in order to build a relationship between building characteristics and electricity consumption.

While reporting data internally, standard metrics are reported for comparison. For example, to compare electricity consumption between locations, only consumption data will not suffice; rather, and consumption per square feet or consumption per person has to be calculated. Organizations require a flexible model to analyze data from multiple perspectives, to derive meaningful metrics from raw data and enable comparison.

Analysts can connect to the database directly from Microsoft® Excel and create custom reports by dragging and dropping fields from the database. This helps the analyst to analyze data and infer meaningful information from it. In a sample scenario, to calculate the electricity usage pattern across various buildings in an organization the analysts may include the below steps.

- Review electricity consumption across various building types in the organization.
- Find that buildings with a glass exterior made of a particular material have the highest electricity consumption.
- Retrieve details of all the buildings that have glass exteriors. The analyst finds that electricity consumption is higher in buildings that are east-facing when compared to other glass buildings.

This analysis gives an insight that is helpful while planning for new buildings as well as while modifying the existing buildings to reduce the electricity consumption.

Similarly, other patterns such as water usage, travel pattern, emission trend, location wise, and unit wise behavior is analyzed easily without having to create new canned reports for them.

## Manage

The Manage process involves setting reduction goals for consumption and emission, creating action plans for reduction, managing offset measures, forecasting, and carbon trading.

The reduction goals provide a quantitative target that an organization must achieve through various activities. An action plan is a defined step in reducing or optimizing consumption in a pre-defined time period; and, each action plan helps the

organization move towards the set goal. The examples of action plans can be reducing electricity consumption by 10% or optimizing water usage by 5%.

**Figure 6: Activities involved in Manage**



In addition to internally managing and tracking environmental performance, organizations should track their compliance requirements and commitments to various external stakeholders. This includes tracking the impact of regulations and managing the organization’s performance for each regulation in order to ensure compliance. Sustainability is a continuous process that requires organizations to set long-term and short-term goals, and also create a roadmap to achieve the goals.

## Summary

Environmental sustainability is no longer a choice but an imperative to save the environment and to sustain businesses in the long run. The proposed 3M model is built around the various activities performed by an organization. It also advocates a high-level approach for organization-wide implementation. The model helps environmental resource tracking by explaining data to be measured and monitored and the activities involved in managing them. This helps organizations to gain greater visibility of the organization’s performance, analyze usage patterns and identify reduction opportunities, enable easier auditing and verification, create greater awareness at the organizational level, compare various sources and locations of emissions and to externally report performance.

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