Energy Efficiency Support Programme

Webinar Energy Audits

December 2018

Agenda

1. Introduction and Objectives
2. Energy Audits: Objectives
3. Energy Audits: Standards and Types
4. Energy Audits: Process
5. Energy Audits : Tools

Webinar Objectives

- Understand the objective and main steps of an energy audit according to best practices and international standards.

CARBON TRUST ECONOLER CLEAN ENERGY SOLUTIONS CENTER ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY ECREEE TOWARDS SUSTAINABLE ENERGY

Introduction

Trainer

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TOWARDS SUSTAINABLE ENERGY

Agenda

1. Introduction and Objectives
2. Energy Audits: Objectives
3. Energy Audits: Standards and Types
4. Energy Audits: Process
5. Energy Audits : Tools

Objectives of an Energy Audit

- Develop an energy balance of a facility and determine the consumption intensity and demand profile of energy
- Preliminary identification of opportunities for further study and investment targeting
- Detailed study to demonstrate feasibility and justify investment in an energy efficiency measure (s)
- Verification of performance of an existing energy efficiency investment

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1. Introduction and Objectives
2. Energy Audits: Objectives
3. Energy Audits: Standards and Types
4. Energy Audits: Process
5. Energy Audits : Tools

Energy Audit standards

- **EN 16247 (EU): Energy audits. General requirements**
  - *An energy audit is an important step for an organisation, whatever its size or type, wanting to improve its energy efficiency, reduce energy consumption and bring related environmental benefits.*

- **ISO 50002:2014, Energy audits: Requirements with guidance for use**
  - *An energy audit comprises a detailed analysis of the energy performance of an organization, equipment, system(s) or process(es). It is based on appropriate measurement and observation of energy use, energy efficiency and consumption. Energy audits are planned and conducted as part of the identification and prioritization of opportunities to improve energy performance, reduce energy waste and obtain related environmental benefits.*

Energy Audit standards

- Which one is best?
  - ✓ **Answer: None of them**. They are all similar and promote the same basic steps!
- Do we need a reference framework for energy audits?
  - ✓ **YES**
- Do all energy audits need to have exactly the same approach, details, etc.?
  - ✓ **NO** – All energy audits are different! Different objectives, different budgets, different systems, etc.

Types of energy audits

- **Walk-Through Analysis/Preliminary Audit**

(ISO 50002 -**Level 1 Energy Audit**)

- **Detailed Feasibility Study / Complex Facility**

(ISO 50002 -**Level 2 Audit**)

- **Advanced Feasibility Study / Large Facility**

(ISO 50002 -**Level 3 Energy Audit**)

Energy Audit Detail Levels

Level 1

Accuracy
- -30% to -50% Savings
- +30% to + 50% Costs

Uses
- Monitoring
- Scoping
- Qualification
- Key feasibility study for small facilities or simple energy systems

LOE (Typical)
- Small-Medium Building
  - 1-2 days on site
  - 1 week office report writing
- Large Building
  - 2 days on site
  - 1-2 weeks office report writing

Level 2

Accuracy
- -15% to -25% Savings
- +15% to + 25% Costs

Uses
- Detailed feasibility
- Firm internal funding requests

LOE (Typical)
- Small-Medium Building
  - 1-2 weeks on site
  - 1-2 weeks office report writing
- Large Building
  - 2-3 Weeks on site
  - 1-2 weeks office report writing

Level 3

Accuracy
- -5% to -10% Savings
- +5% to + 10% Costs

Uses
- Advanced Investment Feasibility Study – more detail for a larger, more complex facility
- External Funding Requests
- System Specific Detailed Feasibility Study

LOE generally the same as Level 2
- LOE determined by detail required and / or complexity of a sub system

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Selecting the Energy Audit Type

- **Key Points:**
  - Level 1 audit is always conducted!
  - Level 1 energy audit is low cost investment and typically used for planning a more detailed audit or as a stand alone audit on simple facilities
  - More detailed audits should not be performed until a firm commitment to project implementation under agreed upon investment qualification criteria has been made
  - The audit detail should depend on the current risk level of the project or and / or accuracy of the energy balance required. Risks depends on:
    - Complexity of the facility and measures
    - Availability of funding
    - Accuracy of data used to analyze opportunities and develop design concepts
    - Capacity of resource available to implement projects

Energy Audit – Level 1

- **Application**
  - Small energy budgets
  - Preliminary for large organizations
- **Needs Addressed**
  - Indication of potential savings from more detailed audits
  - Awareness
  - Identifying strategic areas of focus
  - Defining scope for a more detailed audit
  - Determining scale of opportunity
  - Developing a better understanding of the stakeholders
- **Data Collection**
  - Skills: basic technical training and understanding of systems
  - Using existing data and meters—rules of thumb based on basic parameters
  - Establishing basic energy performance indicators
  - Site equipment list, schedules, duty factors and load factors

Energy Audit – Level 2

Application

- Larger facilities
- Further development of opportunities prioritized in Level 1 audit for investment

Needs Addressed

- Evaluating a range of specific opportunities
- Identifying complex opportunities that require a more detailed study (Level 3)
- Auditor is typically outsourced and has appropriate technical skills and familiarity with particular facility
- Understanding operational factors in detail – budget, procurement, leadership, approvals process etc.

Data Collection

- Requires detailed data including daily profiles
- Detailed variables for production, occupancy, weather correlated to energy use
- Sub-metered data—site data can be sufficient, but temporary metering may be needed
- Data required: design data, O&M data, capital plans, instrument configurations, automation details

Energy Audit – Level 3

Application

- Highly detailed – requires significant input from client
- Cost effective for customers with very large energy spendings
- Can be a focused assessment on a very specific system (compressed air)

Needs Addressed

- More detailed evaluation of a range of specific opportunities
- Detailed cost-benefit analysis with energy and non-energy factors considered
- Must consider strategic business objectives
- Auditor is highly skilled and often a specialist of the specific system; often requires outsourcing to specialist

Data Collection

- Detailed load profiles examined; examining variables in parallel
- May need to instrument key processes
- Development of detailed energy mass balance could be required for process
- Data required: design data, O&M data, capital plans, instrument configurations, automation details

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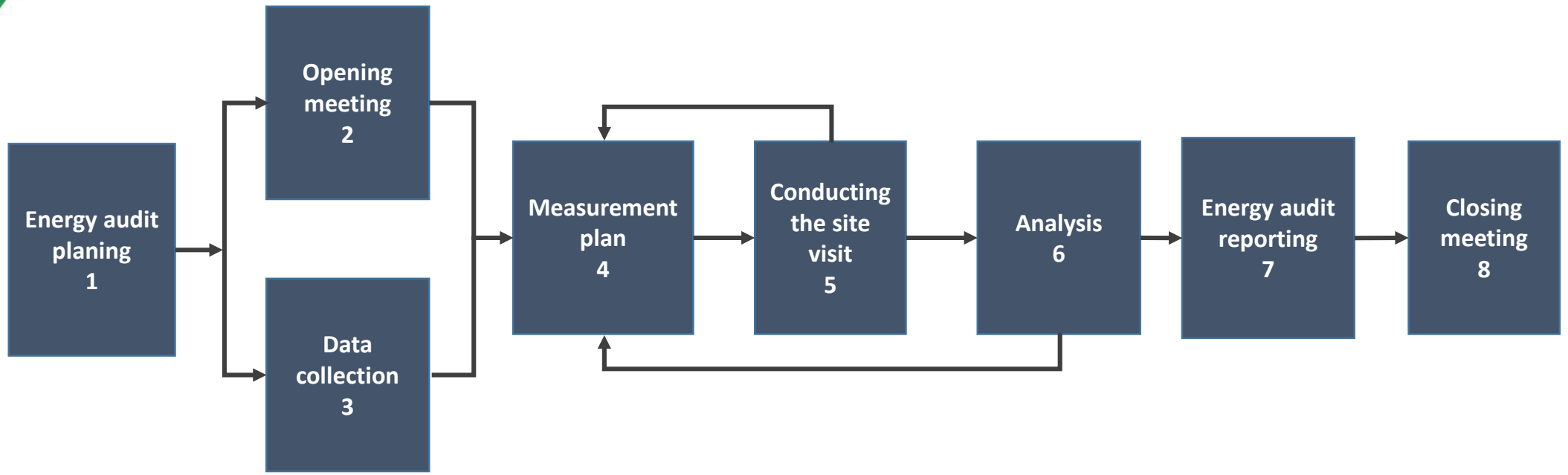
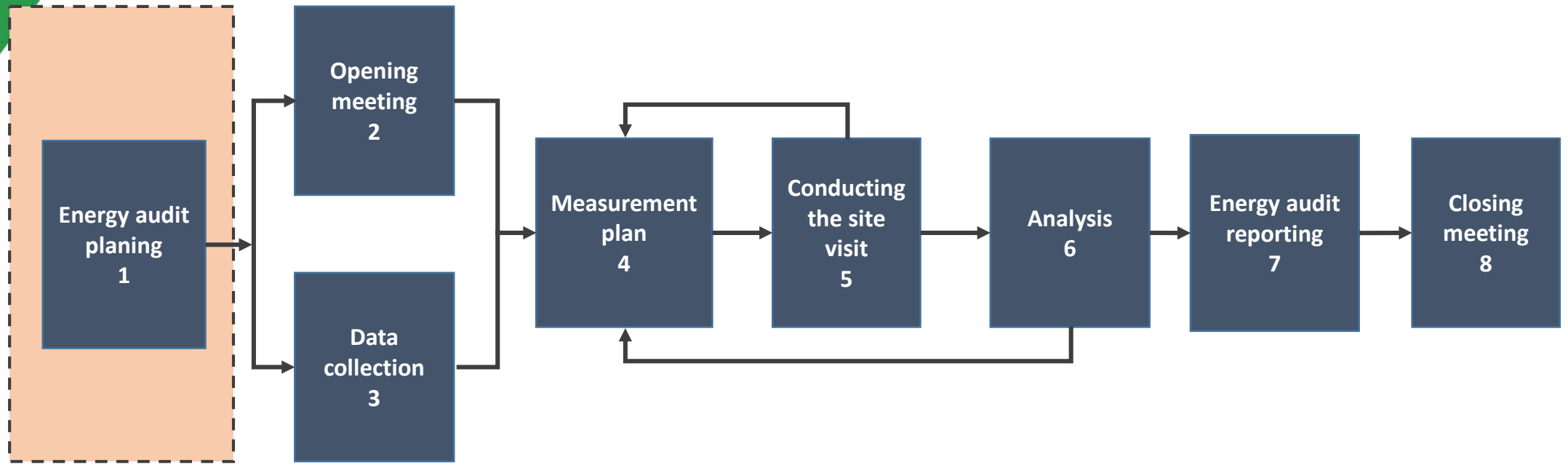
Energy Audit Process: ISO 5002



Step 1: Energy Audit Planning



Step 1: Energy Audit Planning (1/7)

- **Stakeholder Communication**
  - Hold meeting with key organizational stakeholders
  - Determining the energy audit objectives Roles, responsibilities, data requirements, resources
  - Investment criteria
  - Determining the scope, timeframe
  - Selecting audit type/detail, reporting format, approval process
  - Reviewing management systems (EnvMS, EnMS, etc.)
  - Reviewing organizational, regulatory or other constraints
  - Consulting with the initial facility stakeholders
  - Disclosing any conflict of interest

Step 1: Energy Audit Planning (2/7)

- How is energy use related to
  - General business operations
  - Market positioning
  - Technology pressures
  - Work environment
  - Productivity
  - Quality
  - Energy and resource security
  - Etc.

Step 1: Energy Audit Planning (3/7)

- Review investment criteria and other business issues
  - Support investment rationale according to financial performance criteria (MARR, NPV, etc)
  - Identify key business challenges and discuss the relationship with energy
  - Discuss critical project qualification parameters (internal funding, investment horizon, perceived investment risks,e tc.)
  - Discuss past and current initiatives, vendors, and procurement requirements.

Step 1: Energy Audit Planning (4/7)

- **Key Activities and Discussion Topics**

  - Hold meeting with key organizational stakeholders to socialize energy audit initiative
  - Determine what audits and project development activities have been conducted previously – What other, related initiatives are in progress or completed?
  - Establish development stage of previously identified projects (if there are any)
  - Review business priorities and use to rationalize target projects as necessary
  - Review capital investment plans
  - Determining the potential energy audit objectives roles, responsibilities, data requirements, resources
  - Selecting audit type/detail, reporting format, approval process
  - Reviewing management systems (EnvMS, EnMS, etc.)
  - Reviewing organizational, regulatory or other constraints

Step 1: Energy Audit Planning (5/7)

- **Potential Technical Objectives and issues:**
  - Key technical risks associated with energy efficiency projects
  - Discuss critical compliance issues that energy efficiency can address
  - Discuss internal capacity to deliver projects and outsourcing potential
  - Training needs
  - Critical maintenance issues

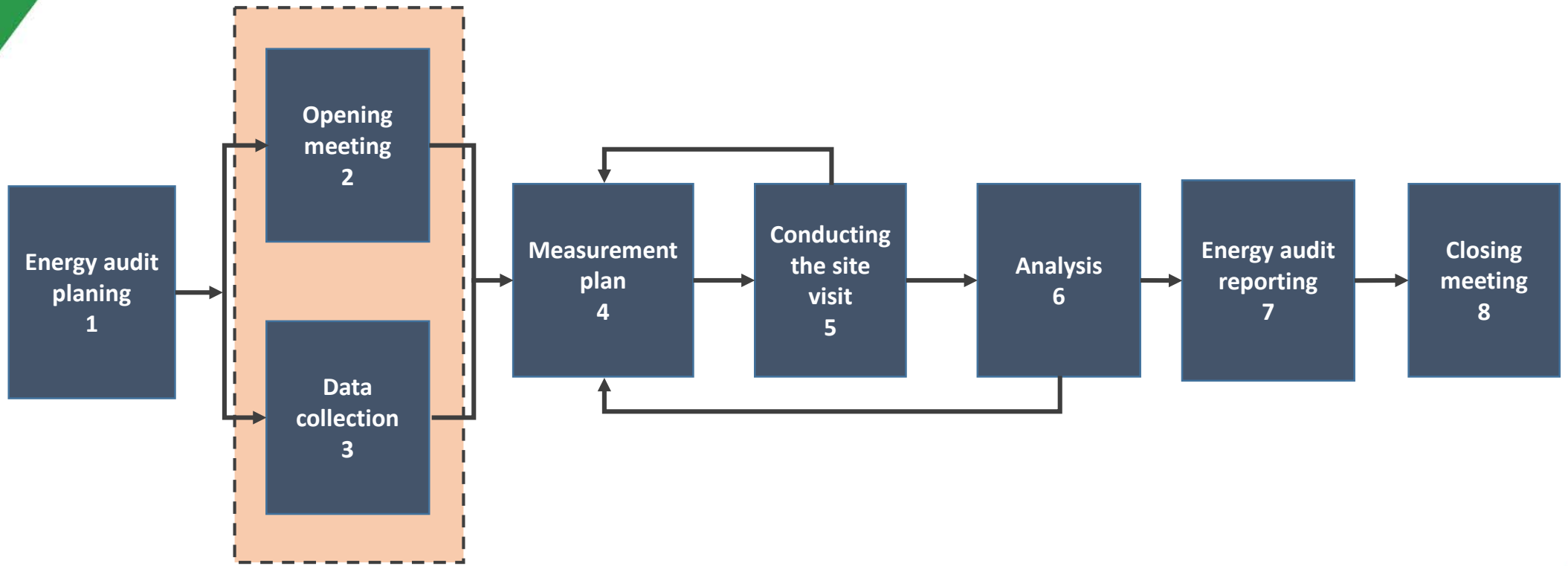
Step 1: Energy Audit Planning (6/7)

- **Discuss Project Scope and Time Frame:**
  - Core opportunities vs. resources
  - Establishing cost centers – groups involved
  - Discussing interactive effects
  - Discussing project phasing / piloting
  - Buildings / zones to be included or excluded
  - Capital planning impacts
  - Extent of process modifications that are permissible
  - Infrastructure that is currently managed through outsourcing
  - Key timing issues:
    - Facility operating modes
    - Desired implementation start date
    - Process planned downtimes

Step 1: Energy Audit Planning (7/7)

- **Outcomes**
  - Agreement to move forward with audit
  - Terms of reference
    - Scope
    - Roles and Responsibilities
    - Deliverables
    - Preliminary data (basic utility data, production data, site plan, etc.)
    - Time frame
  - Key contacts for energy audit
  - Higher Management Support
  - Obtain basic facility data

Step 2/3: Opening Meeting and Data Collection Initiation (1/4)



Step 2/3: Opening Meeting and Data Collection Initiation (2/4)

Review Roles, responsibilities and expectations for cooperation

- Data required and when
- Access to facilities
- Timeframes for data collection on site
- Organize copying, retrieving documents, etc.
- Key personnel on site to access specific areas

Key Point: The facility staff are part of your audit team!

Step 2/3: Opening Meeting and Data Collection Initiation (3/4)

Establish site access requirements and safety

- Security clearances?
- Site inductions for safety
- Special clothing / personal protective equipment
- Liability releases / insurance for site work
- Measurement equipment safety inspection requirements

Time is money – understanding the site requirements will reduce delays!

Step 2/3: Opening Meeting and Data Collection Initiation (4/4)

Submit Data Requests (This should have already been done once during planning!)

- Utility data, sub-metered data, key production/occupancy data
- Equipment inventory
- O&M records
- Scheduling data (process, business hours, holidays, etc.)
- Past studies & reports
- List of contractors who maintain specific energy systems

Key Point:

Ask for data *early* and *often* – make a check list for the site / client and prioritize the requests according to the importance!

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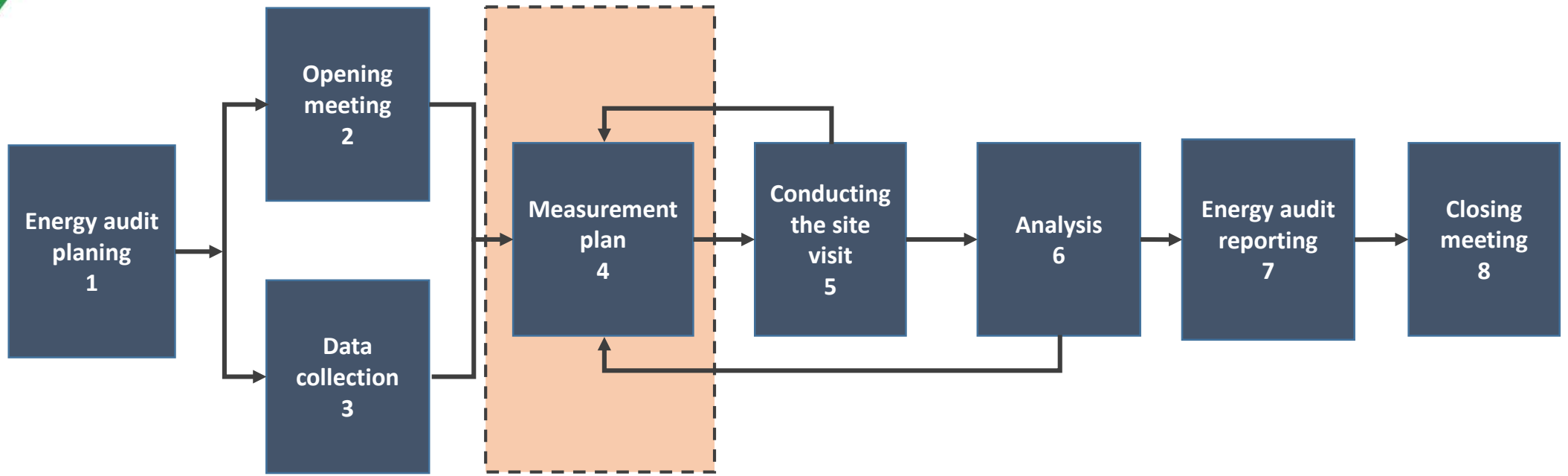
Step 4: Measurement Planning (1/6)



Step 4: Measurement Planning (2/6)

Pre-Site Visit Data Collection

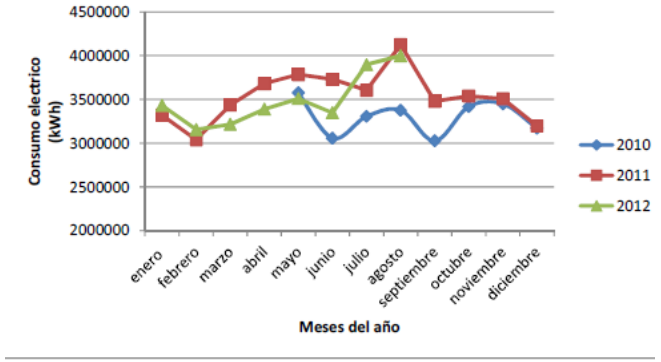
- Utility bills (Do not go to site without first reviewing!)
- Review of drawings and specifications
  - Single-line electrical drawings
  - High-level process schematics (e.g. energy and mass flow diagrams)
  - HVAC plans
  - Architectural layouts with lighting fixture placements
  - Site plan (Alternatives / Substitutes: Emergency exit plan, google maps)
- Review of specific operational issues / delayed maintenance item

Key Point: Often a short meeting with the customer is the best way to see what kind of information is already available

Step 4: Measurement Planning (3/6)

Pre-Site Visit Data Review

- Energy analysis before the visit
  - Energy bills analysis of the last three years
    - Electricity
    - Biomass
    - Gas
    - Fuel oil
  - Summary of bills and average monthly use
  - Estimate the key energy indicators (Key Performance Indicators - KPI):
    - Buildings: kWh/m2-year
    - Factories: Energy / quantity of product (e.g. GJ/ton, GJ / unit)
    - Hotels: Energy / guest
    - Hospitals: Energy / patient or bed



KPIs can be used to determine performance, fix EE objectives, monitor progress and benchmark different facilities/equipments.

Step 4: Measurement Planning (4/6)

- **Electricity bill analysis – BEFORE the visit**
  - Check for power factor penalties
  - Check if subscribed demand is adequate
  - Check for errors / irregular patterns
    - ➢ If inexplicable, may indicate a defective utility meter.
    - ➢ Should be investigated for a possible refund from the utility
  - Check if the rate applied is the best considering the existing energy usage pattern

Step 4: Measurement Planning (5/6)

- **Analysis of KPIs**
  - Comparison with similar facilities / industry
    - Find an appropriate database for benchmarking
    - Is the energy usage less or more than the average building / enterprise of same type?
    - Providing an indication of the potential for energy efficiency improvement
  - If benchmark comparisons are not possible at the facility level – focus on benchmark comparison at the energy sub-system levels:
    - Compressed air production
    - Hot water production
    - Steam production
    - etc

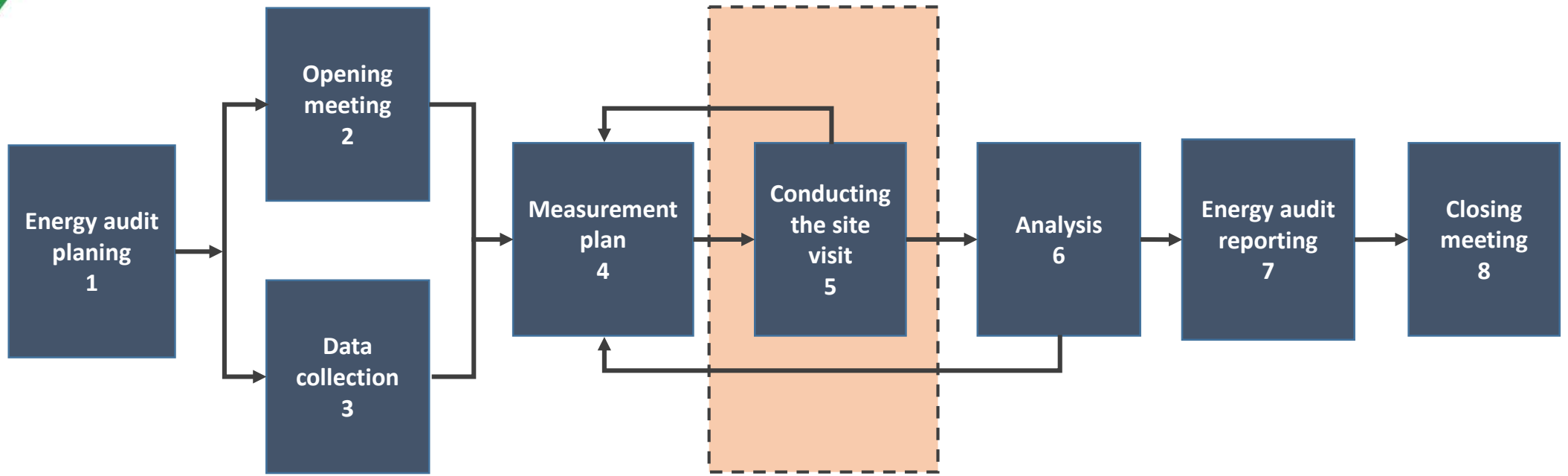
Key Point:
Making benchmark comparisons to other facilities is often difficult because KPI tend to be unique to a particular facility context (climate, product/process type, etc.)

Step 4: Measurement Planning (6/6)

Preparation

- Select appropriate checklists to use during site visit
- Ensuring equipment is available / ensuring calibration
- Ensure all access requirements are known and accounted for in planning
- Use appropriate personal protective equipment and clothing
- Understand particular site requirements for tools and equipment

Step 5: Conducting the Site Visit (1/9)



Step 5: Conducting the Site Visit (2/9)

Key Considerations for measurements to estimate energy USE

- Do we need to measure everything? NO
- We need to measure enough data to estimate energy use and savings appropriate for the required level of accuracy
- It is impossible within most audits to measure all parameters.
- The energy auditor must be an expert at making estimates based on incomplete data.

Step 5: Conducting the Site Visit (3/9)

Interviews and Meetings

- **Meeting with Facility Personnel**
  - Confirm elements that are strategic to them
    - comfort and lighting level improvement
    - reliability of operations
    - equipment rehabilitation
    - more accurate process control
    - cost reduction
    - etc.
  - Confirm open channel of communication
  - Solicit access to existing information!

Step 5: Conducting the Site Visit (4/9)

Interviews and Meetings

- **Meeting with Facility Personnel**
  - › Meet the O&M team at the beginning of the project
  - › O&M staff are a key source of information:
    - they help you fill the gap between hard data (nameplate, measurements) and the facility's annual operations
    - they will operate new systems or equipment beyond project implementation

DO NOT overlook this step

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Etape 5 : Conducting the site visit (5/9)

- Type of measurement – Spot Measurements
  - Power probe and multimeter to measure true RMS kW
  - Air pressure gauge to measure fan statics
  - Tachometer to measure fan RPM
  - Light meter to measure foot-candles or lux
  - Thermometers to measure various temperatures
  - Boiler stack gas analyzer to measure combustion efficiency
- Type of measurement – Short-term Monitoring
  - Compact portable equipment monitoring
    - Electric current or power
    - Lighting or motor runtime
    - Occupancy schedules
  - Stand-alone battery powered
  - Split-core CTs and other types of sensors
  - CPU and sensors connected by twisted pair wiring

- Types of measurement– Long Term monitoring
  - “Permanently” installed equipment
  - Wall receptacle power with battery backup
  - Solid-core current transducers (CTs) and other types of sensors
  - Twisted pair wiring, power line carrier, or radio-frequency connections between sensors and CPU that may be remotely located
  - Typically monitors high-value loads

STEP 5: CONDUCTING THE SITE VISIT (6/9)

Equipment Survey Form - Example

DO NOT FORGET IDs

- On-site Survey and Measurement

Room Description	Equipment Description	quantity of equipment (Unit)	Total Power per unit (W)	Total Total Power (kW)	Sched. Number	Sched. Description
101	Small freezers and coke machines	8	1200	9.6	13	Freezers and cold rooms equipment
102	Cash registers	3	750	2.25	1	Hourly lighting schedule for store
103	air conditionner 18 000 BTU	8	2000	16	5	Air conditionning split systems #1 -- store
103	miscellanious equipment	3	750	2.25	1	Hourly lighting schedule for store
103	air conditionner 18 000 BTU	6	2000	12	5	Air conditionning split systems #1 -- store
103	miscellanious equipment	3	750	2.25	1	Hourly lighting schedule for store
104	Cash registers	2	750	1.5	1	Hourly lighting schedule for store
105	Evac fan	1	60	0.06	9	Other exhaust fans
105	air conditionner 12 000 BTU	1	1300	1.3	12	Air conditionning split systems #2 -- office
106	computers and office equipment	2	600	1.2	4	Hourly lighting schedule for office
107	Evac fan	1	60	0.06	9	Other exhaust fans
108	air conditionner 12 000 BTU	1	1300	1.3	12	Air conditionning split systems #2 -- office
109	Freezers (incl cond and evap fans)	2	8200	16.4	13	Freezers and cold rooms equipment
109	Coolers (incl cond and evap fans)	3	5500	16.5	13	Freezers and cold rooms equipment
110	UPS and stabilizer	2	1200	2.4	1	Hourly lighting schedule for store
110	Evac fan	1	60	0.06	9	Other exhaust fans
110	Evac fan	1	60	0.06	9	Other exhaust fans
111	Evac fan	1	60	0.06	9	Other exhaust fans
111	Evac fan	1	60	0.06	9	Other exhaust fans

STEP 5: CONDUCTING THE SITE VISIT (7/9)

- **Lighting Measurements**
  - Develop a spot measurement plan for **some typical rooms**
  - For each type of space:
    - do inventory of fixture types (lamp type (LED, CFL, etc), nameplate wattage, number of lamps of each type, light color, ballast type, nameplate wattage of ballasts, troffer type, etc)
    - identify the type of control switching and its layout

  ➢ perform spot measurements (lux, W, amps, V, power factor)

  ➢ Calculate the KPI as W/m2

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Step 5: Conducting the Site Visit (8/9)

On-site Survey and Measurement

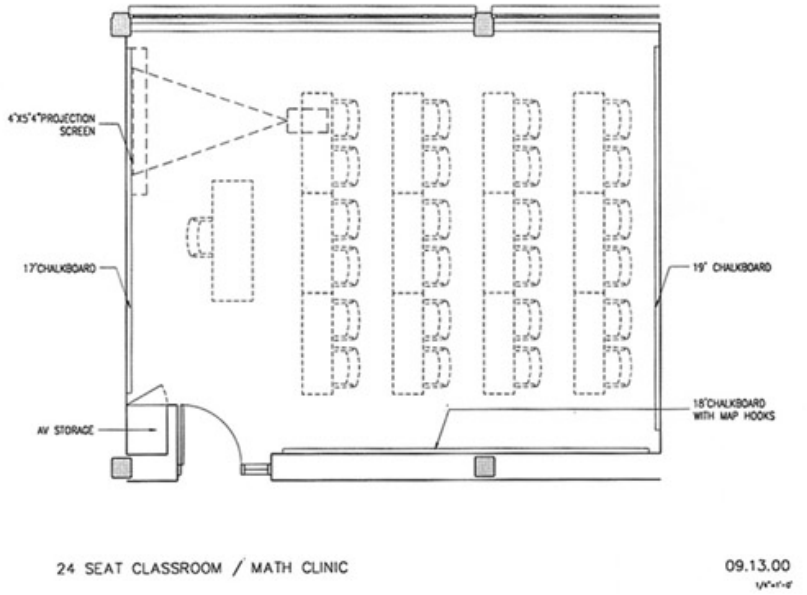
On-site Lighting Survey Form –EXAMPLE

Floor	Room Number	Dimension Area (m^2)	Lux	Quantity of Fixtures (units)	Fixture Type	Number of Lamps/Fix. (units)	Power per Lamp (W)	Power per Ballast (W)	Hours/ Period (hrs)
Right Orchid -Ground Floor – 1-2	101-109	630	150	108	CFL13-Compact fluorescent lamp	1	13	2	15
Right Orchid -Ground Floor – 1-3	101-109	630	100	54	I75-Incandescent 1 lamp x 75 W	1	75	0	15
Right Orchid -Ground Floor – 1-4	101-109	630	90	27	ELV36-Extra Low Voltage	1	50	16	15
Right Orchid -corridors	101-109	180	85	27	I40-Incandescent 1 lamp x 40 W	1	40	0	15
Left Orchid -Ground Floor – 1-2	101-109	630	105	108	CFL13-Compact fluorescent lamp	1	13	2	15
Apartment Ground Floor	21	84	150	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment Ground Floor	22	84	150	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment Ground Floor	23	84	150	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment Ground Floor	24	84	150	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment Ground Floor	25	84	200	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment Ground Floor	26	84	200	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8
Apartment First Floor	27	84	200	7	I40-Incandescent 1 lamp x 40 W	1	40	0	8

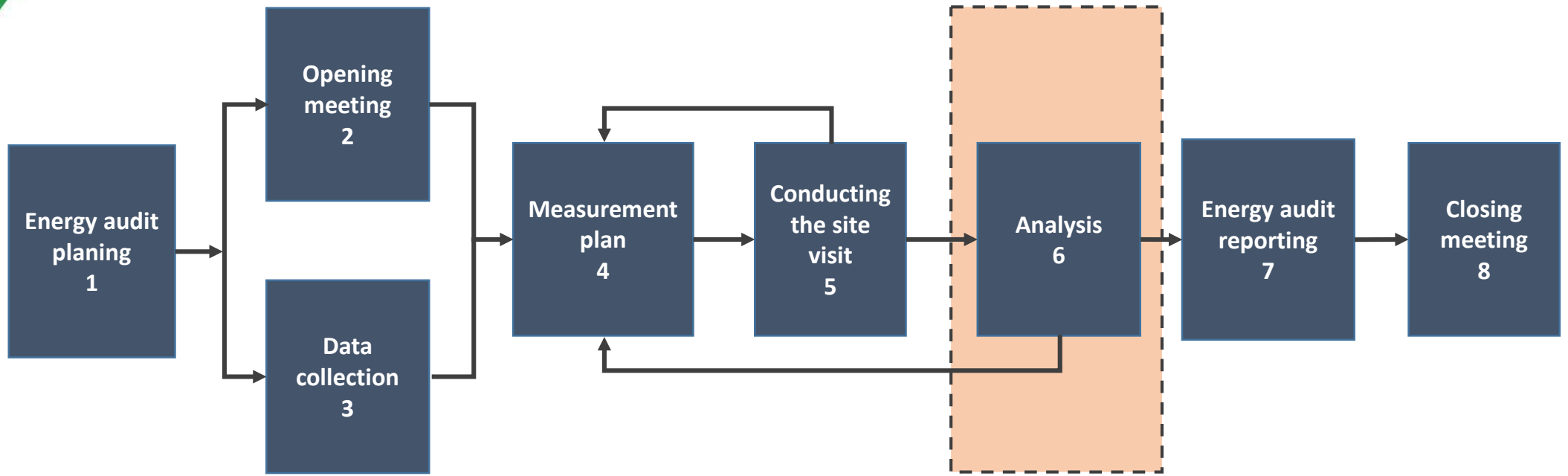
Step 5: Conducting the Site Visit (9/9)

On-site Survey and Measurement

- **Lighting Measurements (con't)**
  - Example Classroom survey:
    - Installed power: 158 W
    - Area: 95 m^2
  - Lighting Energy Density: 1.66 W/m^2
  - Compared to best practice of 0.75 W/m^2



Step 6: Energy analysis (1/15)



Step 6: Energy analysis (2/15)

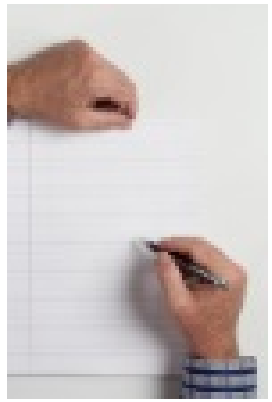
Analysis Detail

- **Preliminary / Rough Analysis (Level 1 Audits / Non-Core Measures)**:
  - Developing target scope for a more detailed study
  - Time and resources are limited
  - The project values are low
  - The facility / energy system and operating profile is simple
- **Detailed Analysis (Level 2 Audits / Core Measures)**:
  - Projects with internal funding available
  - Firm budget commitments for project implementation have been made
  - Moderate complexity systems and operating profiles
- **Advanced Analysis (Level 3 Audit / High Value / High Risk Projects)**:
  - Projects that require solicitation of external funding
  - Moderate complexity systems and operating profiles
  - Where project modifications have significant financial, health and human safety, or environmental risks (e.g. modifications to process, critical environments, etc.)

Step 6: Energy Analysis (3/15)

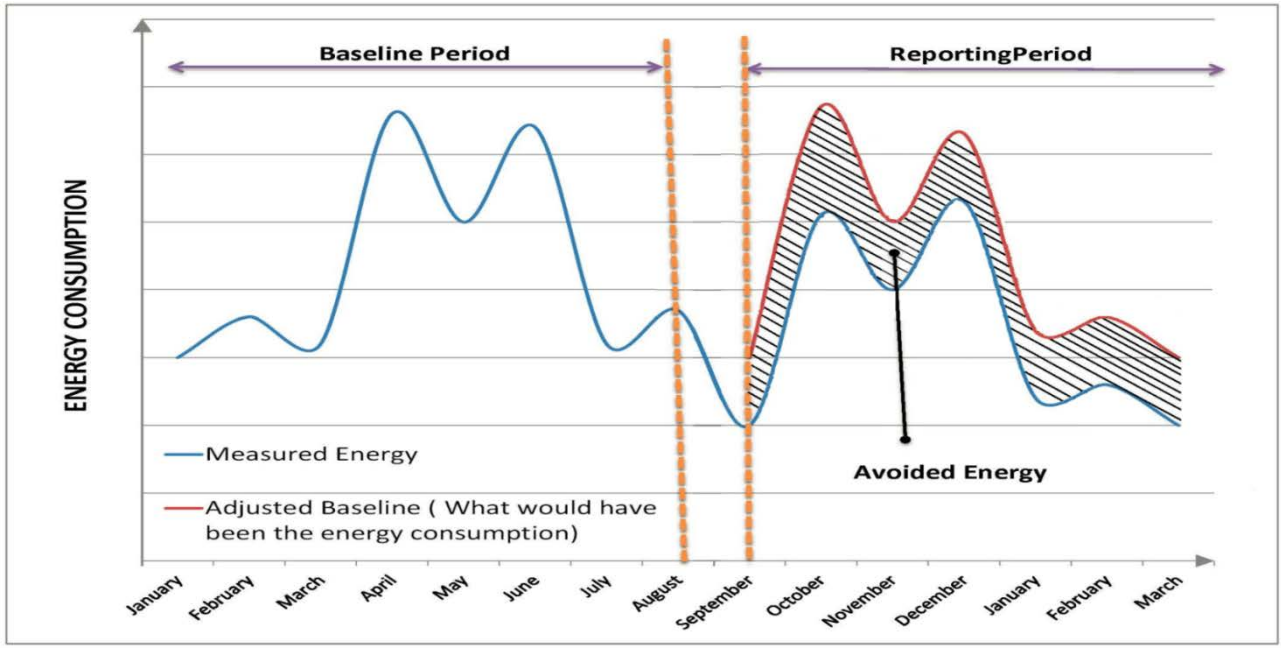
- Evaluations at ± 30% at the Level 1
  - Preliminary analysis tools can be used, i.e. Retscreen
  - Benchmarking with previous projects or best practices

- Identify the range of potential savings - **Not a single figure**
- Always write down **your hypothesis and source for preliminary calculations**
  - More advanced studies and lager investments can take a long time to be approved
  - Document your thinking.
  - Identify the hypothesis that will require refinement during the next, more detailed energy audit.



Step 6: Energy analysis (4/15)

- Definition of BASE LINE
- The baseline is the expected power consumption for the actual period, under actual operating conditions, based on the consumption data history for the selected reference period.



Step 6: Energy analysis (5/15)

Steps to choose the baseline

› Review of invoices for the last three years

Analysis of consumption by an *independent common variable* as well as the monthly distribution of consumption and demand

- Common independent variables: meteorological conditions, volume of production and occupation.
- The weather is often just the outdoor dry temperature.
- Production is usually expressed in units of mass or volumetric units of each product.
- Occupation like that of a hotel room, strengthening office occupancy hours, etc.

› A period is taken as a reference and must represent a *complete cycle* of operation of the installation

Etape 6 : Energy analysis (6/15)

Analysis according to the different uses

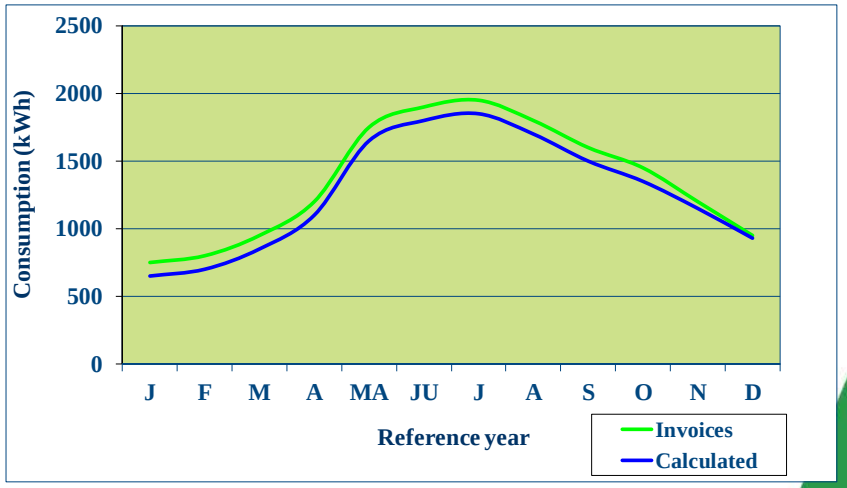
- Electricity
- Lighting
- Motors
- Pumps
- Fans
- Compressed air
- Cooling system
- Boiler

The analyzes should be detailed according to audit levels: I or II or III

Etape 6 : Energy analysis (7/15)

Energy balance

- Establish the history of energy consumption of the equipment
- Compare the estimated load and consumption from survey and measurement data with billing
- Benchmark buildings/equipment
- Prioritize the most important energy consumptions for identification of ECM



Etape 6 : Energy analysis (8/15)

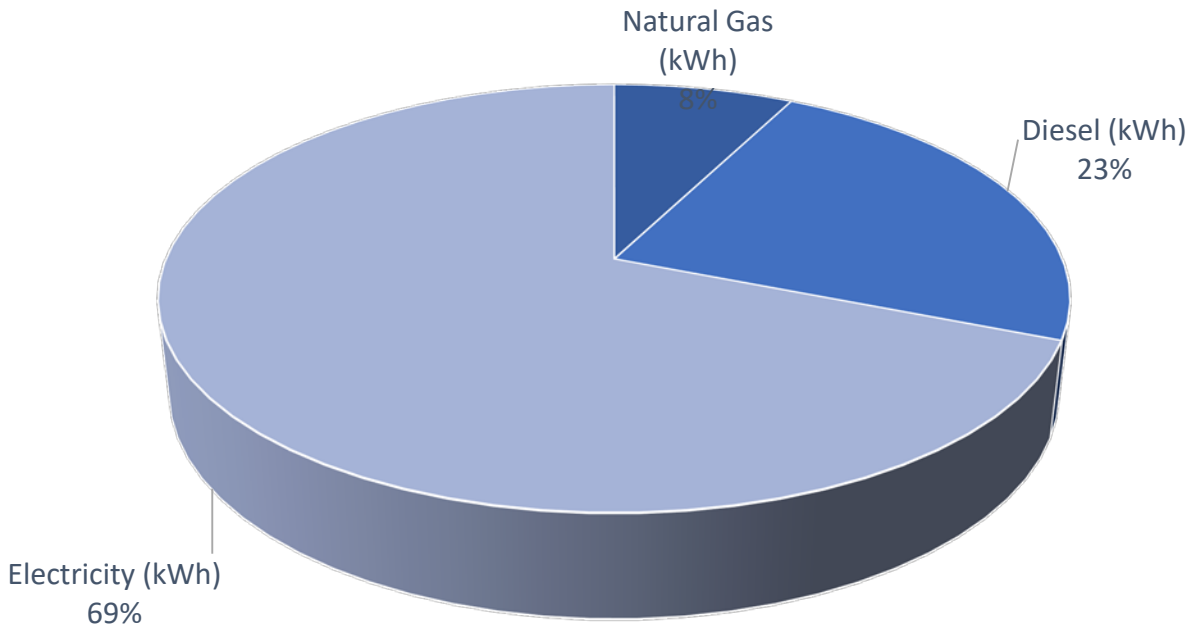
Energy Balance - Presentation

Energy type	Quantity in original units	Quantity in converted units (kWh, etc.)	IPE (kWh/m2/year)	% of total energy consumption
Electricity				
Fuel				
GPL				
Total				

For comparison purposes, the energy provided by fuel oil and liquid gases has been converted to kWh.

Etape 6 : Energy analysis (9/15)

Energy balance – Presentation of Total Consumption



All energy units are converted to kWh

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Etape 6 : Energy analysis (10/15)

- Development of energy efficiency measures
  - Key considerations
    - Accuracy of input data and hypothesis (measurements)
    - Caution (avoid pressure on the listener to generate unexpected savings)
    - Accurate cost evaluation
    - Check price with manufacturer
    - Adopt contractor pricing methods (scaffolding, permits, insurance, security (fence, guard), garbage, site cleaning, temporary heating, etc.)

Etape 6 : Energy analysis (11/15)

- Development of energy efficiency measures
  - Consider potential risks
    - calculation errors
    - technological failures
    - the time to repair; other equipment
    - control of the measurement by the operator; training
    - need continuous supervision; real time measurement
  - M & V
    - select the method of M & V
    - describe the M & V plan (but DO NOT fully develop the plan at this stage, as the investment plan may change)

Etape 6 : Energy analysis (12/15)

- Development of energy efficiency measures
  - Cost of changes
    - Include and detail all costs per item
    - These costs are real costs, without administration, management, or potential benefits
    - These cost elements will be evaluated by the SEA Approval Committee.
    - Finally, an overall cost including overhead, profit, performance guarantee premium and financing will be determined and presented to the client.

Etape 6 : Energy analysis (13/15)

- Development of energy efficiency measures
  - Costs to be determined by the project manager (1/3)
    - Energetic audience
      - cost mentioned in the contract

    - Engineering: professional services for the preparation of drawings and specifications
      - the engineering costs must be detailed
      - include hourly rate and number of hours

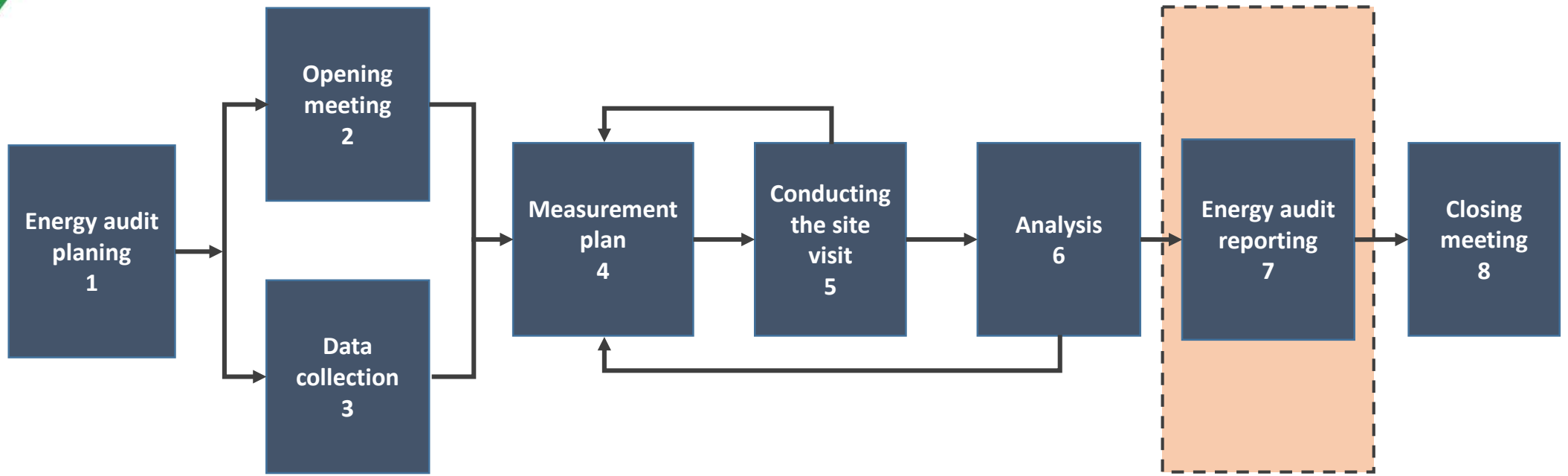
Etape 6 : Energy analysis (14/15)

- Development of energy efficiency measures
  - Costs to be determined by the project manager (2/3)
    - Implementation of the proposal: materials, labor, contractors / construction specialists needed to carry out the work
      - cost of all equipment, accessories and contractors must be detailed
      - include hourly rates and hours

Etape 6 : Energy analysis (15/15)

- Development of energy efficiency measures
  - Costs to be determined by the project manager (3/3)
    - Work supervision
    - Measurement and verification (M & V) of savings
      - budget description, including measurement time, frequency and equipment purchases
    - Project management

Step 7 : Energy Audit Reporting (1/6)



Step 7: Energy Audit Reporting (2/6)

WTA Report

- **Objectives**

➢ Summarize the findings of the WTA stage

➢ Convince the facility owner to get on board

➢ Make it reader-friendly and comprehensive for busy managers

➢ Submit a professional and to-the-point presentation

Step 7: Energy Audit Reporting (3/6)

WTA Report

Report Structure (1/2)

➢ Content

- Executive summary
- Current characteristics and operations of the facility
- Brief description of electrical and mechanical systems
- Energy consumption summary
- Proposals and recommendations for energy-saving measures
- Conclusion

Step 7: Energy Audit Reporting (4/6)

WTA Report

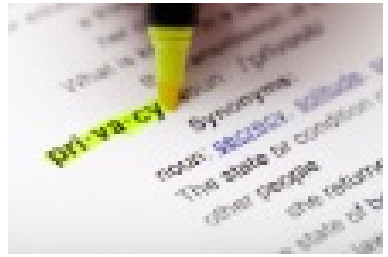
- **Report Structure (2/2)**

Annexes and Survey Forms (not disclosed to facility owner)

- Measures: preliminary calculations
- Summary for ESCO upper management
- Cost estimates for the detailed energy audit (including all costs)

Step 7: Energy Audit Reporting (5/6)

IGA REPORT OBJECTIVES



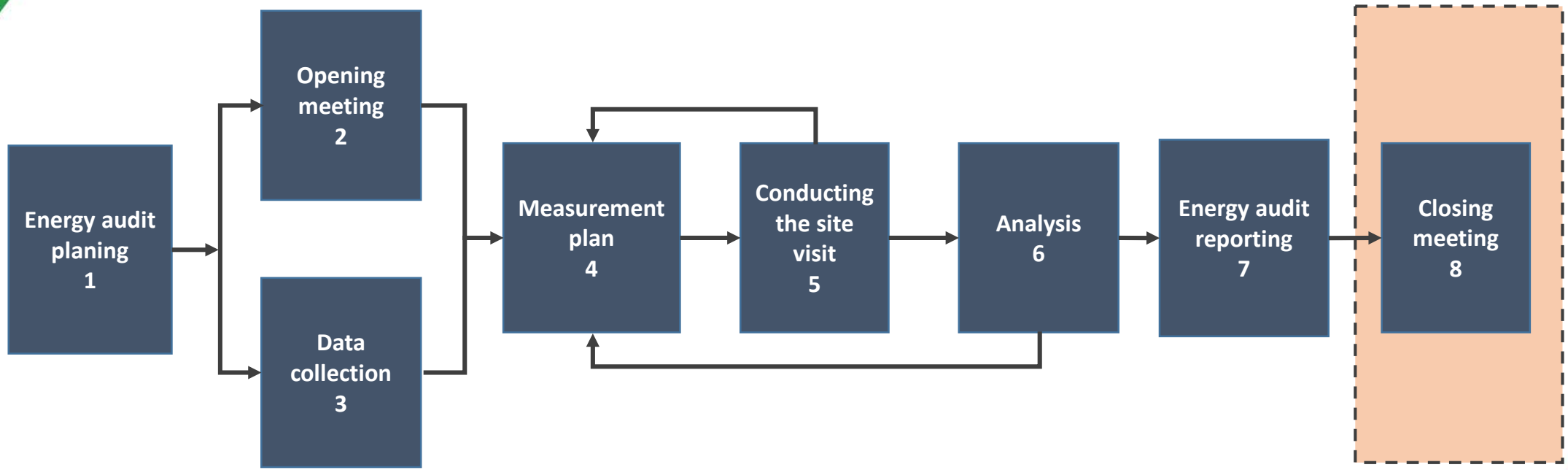
- Record all baseline information
  - ➢ energy usage, associated equipment and operating mode
- Present the refined evaluation of the energy savings potential and project cost
  - ➢ compare with the WTA preliminary assessment
- Level 3: ESCO is comfortable guaranteeing savings and cost
- The facility owner receives a detailed report highlighting the proposed project and analysis

Step 7: Energy Audit Reporting (6/6)

Level 3 - Report Structure

- Executive summary
- Introduction
- Facility Description
- Facility Condition Assessment
- Energy Analysis
- Energy efficiency proposals and recommendations
- Summary of Recommendations
- Conclusion and Next Step

Step 8 : Closing meeting



ENERGY AUDIT TOOLS

CARBON TRUST

ECONOLER

CLEAN ENERGY SOLUTIONS CENTER
ASSISTING COUNTRIES WITH CLEAN ENERGY POLICY

ECREEE
TOWARDS SUSTAINABLE ENERGY

OUTILS D'AUDIT ENERGETIQUE

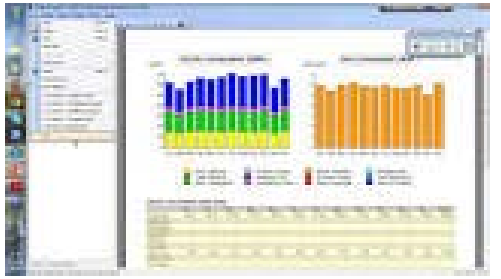
- RETScreen

- RETScreen is a clean energy management software system for the feasibility analysis of energy efficiency, renewable energy and cogeneration projects as well as for continuous energy performance analysis.
- https://nrcaniets.blob.core.windows.net/iets/RETScreenExpertInstaller.exe

- QUEST

- eQUEST was designed to provide a detailed analysis of state-of-the-art building design technologies using energy-saving simulation techniques for the most sophisticated buildings.

http://www.doe2.com/download/equest/eQUEST_3-65_Build7175_2018-10-04.msi



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Thank for your attention

ECONOLER

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