International Energy Agency

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Toolkit: Energy efficient building operations

Buildings: Maxine Jordan, IEA and Ian Hamilton, UCL Energy Institute

Pretoria, Wednesday 16th October 2019

Buildings energy efficiency sessions in partnership with:

UCL ENERGY INSTITUTE

UCL

Energy Efficiency Training Week: Buildings programme

1. Where to start: Energy use in buildings
2. Where to start: Energy efficiency potential in buildings
   Special session: GlobalABC Regional Roadmaps
3. Toolkit: Energy efficient building design technologies
4. Toolkit: Energy efficient building system technologies
   Special session: Green Building in Africa – *Elizabeth Chege, KGBS*
   Special session: The GlobalABC Africa Roadmap for buildings and construction
5. What are the steps? Determining the current status of policies
6. Toolkit: Energy efficiency policies and target setting *with guest speaker: Hlompho Vivian, GBC SA*
7. What are the steps? Implementing codes and standards
8. **What are the steps? Building operations and procurement** *with guest speaker: Christelle Van Vuuren, Carbon Trust*
   Special session: The multiple benefits of energy efficiency
9. Did it work? Evaluation and energy efficiency indicators
   Special session: Financing energy efficiency in buildings
10. Buildings quiz

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Guest speaker – Christelle Van Vuuren, Carbon Trust

See attached presentation.

Energy Efficiency Training Week: Buildings

8. What are the steps? Building operations

Trainers: Maxine Jordan, IEA

Purpose: To teach the fundamentals of how energy efficiency can be used in operations and management of buildings to reduce energy consumption.

Scenario: The Mayor wants to show leadership by example in the operation of public buildings

Discussion question: How do you deliver energy savings through buildings operations?

What operations are we talking about?

- Building operations consists of the activities necessary to **operate**, **maintain**, and **manage** buildings. This includes maintaining the HVAC systems, plumbing, electrical, and building system configuration.

- Operation and management activities, methods, and approaches should **enable energy savings** while maintaining or enhancing **indoor environmental quality** and **equipment reliability**.

- Good operation and management practices will lead to the efficient operation of buildings. Can also lead to increased **productivity** of occupants, and a **longer lifetime** of the building and its components.

- Operation management Improvements focus on:
  - Management: goals, planning, accounting
  - Teamwork: staffing, training, outsourcing
  - Resources: documentation: tools, assessments
  - Energy-Efficient operation and maintenance: Tune-up, automated controls, scheduling, tracking, prevention

Asys smart management, 2019

PECI, 2000

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- Write on a post-it the key technologies for reducing operational energy use in buildings that should be used today

Energy management

Resources

Key steps

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Energy management in buildings: 7 key steps

1. Initiate an energy management programme
2. Determine efficiency metrics and targets
3. Conduct energy assessments
4. Identify energy savings opportunities
5. Calculate costs and paybacks
6. Implement measures
7. Monitor performance

Adapted from: India Bureau of Energy Efficiency, Energy Management in your School, Hospital, Hotel.

Step 1: Initiate an energy management programme

- Understand the existing energy use situation
- Identify a core team
- Identify and set specific objectives, which will guide:
    - Developing and communicating a plan
    - Motivating stakeholders and staff members

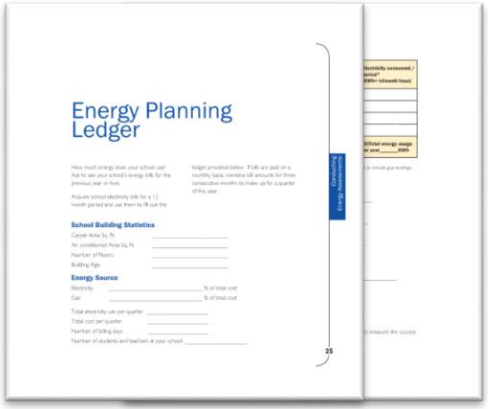
Adapted from: India Bureau of Energy Efficiency, Energy Management in your School, Hospital, Hotel.

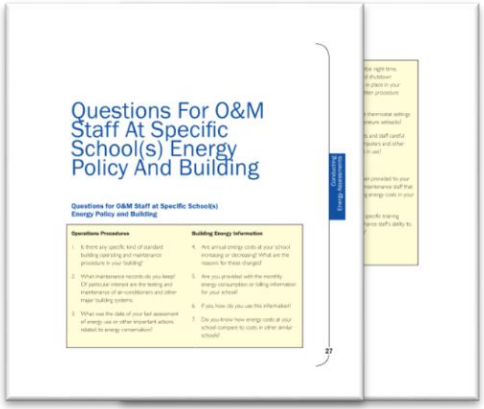
Step 2: Determine efficiency metrics and targets

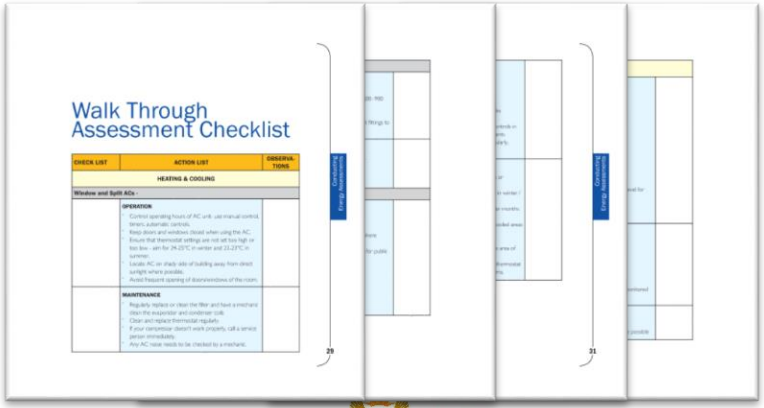
- Follow the path of our training:
  - Examine where is energy being used (session 1)
  - Identify energy efficiency potential (session 2)
  - Identify indicators and metrics
  - Leadership and stakeholder engagement to set targets (sessions 6 and 7)
- Start with aspirational targets identified by experts and leadership

Step 3: Conducting energy assessments

- Simple audit (walk through assessment) or detailed audit (energy analysis assessment)
- Use existing forms and checklists to capture the information
  - Energy planning ledger
  - Questionnaire for building operators
  - Walk through checklist







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Step 4: Identify energy saving opportunities

Follow the path to low energy existing buildings (session 1-1)

- Start with low-cost and no-cost energy sufficiency and efficiency measures

1. **Make energy savings as part of the culture of the organisation**
   - Stakeholder engagement and goal setting
2. **Building improvements**
   - Reduce electrical loads
   - Improve building envelope
   - Upgrade equipment components
3. **System replacement options**
   - Change equipment to be more efficient and correctly-sized
4. **Retro-commission**
   - Address maintenance and repair issues
   - Identify changes in operations

Adapted from: India Bureau of Energy Efficiency, Energy Management in your School, Hospital, Hotel; and ENERGY STAR

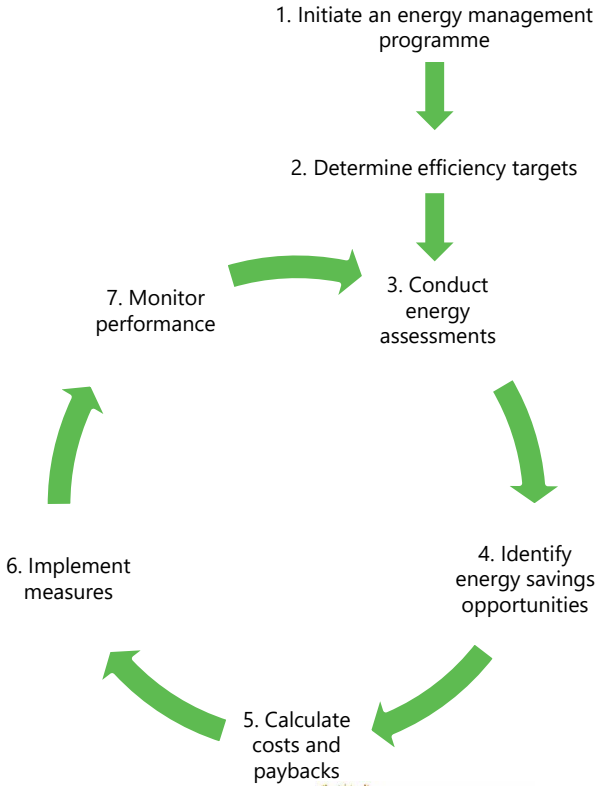
Step 5: Calculate costs and paybacks

- **Consider the cost analysis type needed:**
  - Simple payback method
  - Return on investment of internal rate of return (IRR)
  - Cost benefit analysis
  - Net present value (NPV)
  - Lifecycle assessment (LCA)
- **Increasingly understand the impact of:**
  - Future energy prices
  - Full range of benefits (multiple benefits of energy efficiency)

Adapted from: India Bureau of Energy Efficiency, Energy Management in your School, Hospital, Hotel.

Steps 6 & 7: Implement measures & monitor performance

- Implement energy efficiency measures
  - All cost effective measures that have benefit to owners and occupants
- Monitor performance
  - Evaluation of energy efficiency
  - Data collection / sensors / energy management systems
- Continuous improvement
  - Use the information collected to continue the process again back at step 3 to identify more energy savings opportunities for continuous improvement



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How to increase use of energy management?

- **Technologies:**
  - Tools to facilitate energy audits
  - Meters, submeters, smart meters
  - Sensors, controls, building energy management systems
  - Maintenance tools, fault detection
  - Storing information through building passports
- **Policies**
  - Mandatory disclosure
  - Tools for benchmarking energy use and rating
  - Making benchmarking mandatory
  - Requirements for mandatory regular energy audits
  - Requirements for retro-commissioning
  - Rewarding efficient operational energy use
  - Requiring building passports

A roadmap for Operations

- In your groups, take 5 mins to select at least one technology that could most help improve the operation of buildings
    - Common, Good, Best

- In your groups, take 5 mins to select at least one policy that could most help improve the operation of buildings
    - Common, Good, Best

- Now have a think about achievable and aspirational targets for 2030, 2040, 2050 for one technology and one policy

Global Alliance for Buildings and Construction

Policies

		Baseline status (2019)	Short-term (2030)	Medium-term (2040)	Long-term (2050)
Enables energy performance tracking and comparing of buildings for improved building operations. Can also be linked to incentive or investment tools.	**Benchmarking & rating systems** (countries with none)	No benchmarking or rating systems in place.	Achieve: voluntary system in place Aspire: mandatory system	Achieve: 20% of buildings rated Aspire: 66% of buildings rated	Achieve: 40% of buildings rated Aspire: 100% of buildings rated
	Benchmarking & rating systems (countries with existing rating systems)	Benchmarking and rating systems in place.	Achieve: mandatory system Aspire: 66% of buildings rated	Achieve: 66% of buildings rated Aspire: 100% of buildings rated	Achieve: 100% of buildings rated Aspire: 100% of buildings rated
Enables tracking and storing of information about the building including energy use. Facilitates mandatory disclosure.	**Building passports and disclosure**	Few countries with building passports	Achieve: 30% building passports Aspire: 50% building passports and disclosure	Achieve: 50% passports and disclosure Aspire: 100% passports and disclosure	Achieve: 100% passports and disclosure Aspire: 100% passports and disclosure
Providing financial support such as loans to enable private investment for building operation tools.	**Fiscal incentives**	Few financial incentives available for high performance buildings	Achieve: 5% incentive available Aspire: 20% incentive available	Achieve: 10% incentive available Aspire: 30% incentive available	Achieve: 20% incentive available Aspire: 60% incentive available
Analyses the energy flows in the building and identifies priority retrofit measures.	**Energy audits**	Regular energy audits uncommon	Achieve: 20% annual audits for non-res Aspire: 35% annual audits	Achieve: 40% annual audits for non-res Aspire: 70% annual audits	Achieve: 60% annual audits Aspire: 100% annual audits

Global Alliance for Buildings and Construction

Technologies

		Baseline status (2019)	Short-term (2030)	Medium-term (2040)	Long-term (2050)
Timely maintenance can be achieved by using operation and maintenance manuals. Active fault detection can be integrated with the BMS for new buildings for identifying maintenance needs.	**Maintenance tools** (countries with no or few maintenance tools)	Maintenance tools non-existent or uncommon	Achieve: 25% O&M manual Aspire: 100% O&M manual	Achieve: 50% O&M manual Aspire: 100% O&M manual	Achieve: 70% O&M manual Aspire: Active fault detection
	Maintenance tools (countries with maintenance tools)	Maintenance tools available, including digital tools.	Achieve: 30% active fault detection Aspire: 50% active fault detection	Achieve: 50% active fault detection Aspire: 70% active fault detection	Achieve: 70% active fault detection Aspire: 100% active fault detection
Tools to facilitate energy auditing and identify priority retrofit measures.	**Energy audits**	Few tools for automation of energy audits.	Achieve: 10% audit tools Aspire: 20% audit tools	Achieve: 50% audit tools Aspire: 70% audit tools	Achieve: 100% audit tools Aspire: 100% audit tools
Enables the optimisation of the operation of systems based on internal and external conditions	**Sensors and controls**	Smart controls uncommon	Achieve: 20% smart Aspire: 40% smart	Achieve: 40% smart Aspire: 60% smart	Achieve: 70% smart Aspire: 100% smart
BMS can range from full-scale building software to simple controls that manage individual technologies within a building.	**Building management systems (BMS)**	Typical: simple or programmable Exceptional: learning and fault detection	Achieve: 30% smart Aspire: 50% smart	Achieve: 50% smart Aspire: 70% smart	Achieve: 80% smart Aspire: 100% iBEMS

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