Energy Efficiency

The key pillar of Cambodia’s Energy Future
Energy Efficiency for Low-carbon Development

Energy efficiency means using less energy to provide the same service. For example, an LED lamp is more efficient than a traditional incandescent bulb as it uses much less electricity to produce the same amount of light. Similarly, an efficient air conditioner takes less power to cool your home to a given temperature than a less efficient model.

The phrase ENERGY EFFICIENCY is often used as a shorthand to describe any kind of energy-saving measure, though technically it is different from energy conservation. The concept of energy conservation implies reducing the use of energy, which can also include behavior change. Examples of energy conservation are turning off computers and lights in the office during lunch breaks or using natural ventilation to cool a building instead of electricity consuming air conditioning.
Energy Efficiency Goals

Energy Intensity

Energy intensity is used to measure the energy efficiency of an economy. It is calculated as units of energy used to produce one unit of welfare (expressed in GDP). The conventional fossil-fuel based development path implied the increase of energy intensity with raising prosperity. In contrast, the new low-carbon development aims to decouple economic activities from energy use.

Policy Goals

ASEAN’s countries have committed to reducing its total energy intensity by 30% in 2025 compared to the 2005 level. At the national level, Cambodia targets to reduce the final energy consumption by 20% in 2035 as compared to the business-as-usual scenario. This would result in reduced energy intensity of 65% in 2035 relative to 2014.

The Royal Government of Cambodia has drafted the National Energy Efficiency Policy which sets the goal to reduce energy use in industries and buildings by 25% and in the transport sector by 15%. These targets could be achieved cost-effectively by applying a four-folded strategy focusing on (1) awareness-raising, (2) financial incentives, (3) capacity building, and (4) energy efficiency standards.
Green and efficient Buildings

THE CONSTRUCTION BOOM AND SAVING OPPORTUNITIES

The construction industry has experienced remarkable growth since Cambodia opened to foreign investment in the 1990s. Construction is along with garments, rice, and tourism, one of the four pillars of the country’s economy. Since the year 2000, Cambodia’s Ministry of Land Management, Urban Planning and Construction (MLMUPC) has approved 43,136 construction projects on a total land area of 114 million square meters with an investment capital more than US$43 billion.

The building sector is the largest final energy consumer after transport and industry, with an estimated share of 40%.[1] It is estimated that buildings’ energy consumption will more than double until 2040. Promoting energy efficiency could save up to 25% of building energy use and result in cumulative CO₂ emissions savings of 17.8 million tons[2]. Furthermore, building users will save Millions US-Dollar in energy bills.

Cambodia today

We can save money and the planet!

40% of energy is used in buildings

17.8 million tons of CO₂ savings through energy efficiency until 2035

17.8 million tons of CO₂ savings equivalent to 300 billion tree seedlings grown for 10 years

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LEARNING ABOUT ENERGY EFFICIENCY IN BUILDINGS

How to design an efficient building in Cambodia

Basic design strategies for more comfort and a lower electricity bill

REDUCE WINDOW AREA

In hot climates, direct solar radiation should be reduced as much as possible. A window area of 20% of the entire building façade can provide proper daylighting. Windows on the east and west façade should be avoided.

SHADING OF WINDOWS

Horizontal shading devices on the southern façade and vertical on the east and west façade can reduce solar heat gains considerably. Awnings and louvers can reduce solar heat gain by 65% on equator facing façades and up to 80% on East and West façades.

MODERN WINDOWS THAT PROTECT FROM THE SUN

Install modern windows that close tightly and have a low solar heat gain coefficient (SHGC <0.25). Low SHGC can be achieved by a low-E coating or a slightly tinted window film. This will also reduce the cooling energy. For commercial buildings double glazing is highly recommended.

BUILDING INSULATION

Building insulation is required to reach and retain low energy levels. This includes highly insulated roofs with a recommended U-value of 0.41 W/m²K or better. A well-insulated roof will also reduce solar heat gains from direct solar exposure.

INSTALL EFFICIENT APPLIANCES

Install only energy-efficient appliances because they are the most efficient and will save you money in the future. If you plan to install a central cooling system, consider the efficient VRF technology. This will not only reduce your electricity bill but also improve the thermal comfort and air quality in your building.

SMART ENERGY METERS

Smart meters display your electricity usage in real-time, so you can see exactly how much you are spending on energy. They can help save you money by identifying energy leakages. You can try out new energy-saving strategies and see in real-time how much energy you save.

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Energy use in households

Energy use in residential buildings is dominated by lighting, cooking, refrigeration, and space cooling. Cooking still has the highest consumption share, in particular, in the rural area, due to biomass use for cooking. This is expected to change because people will purchase more electrical devices as their income levels rise. The penetration rate of highly consuming appliance such as air conditioning and refrigerators are still lower than in the neighboring countries. But those with air conditioning in Cambodia use them on average 14 hours per day, mostly during the night. Space cooling and refrigeration are likely to increase dramatically in the upcoming years, given rising income levels.

**DESIGN FOR SAVINGS**

Climate-responsive building design and the use of energy-efficient technologies can reduce the necessity of cooling. Climate-responsive architecture aims to create a comfortable interior while lowering the building’s reliance on electrical energy. In a hot climate like Cambodia, solar control and natural ventilation are the main design strategies. About 21% of energy savings in Cambodian homes can be achieved by improving natural ventilation, lighting control, energy-saving bulbs, and low-E coated glass. For office buildings, there are 24% energy saving potential by reducing the window area, reflective painting on external walls and roof as well as energy-saving light.

**HOMES 21% SAVINGS through**
- **NATURAL VENTILATION**
- **LIGHTING CONTROL**
- **ENERGY-SAVING BULBS**
- **LOW-E COATED WINDOWS**

**OFFICES 24% SAVINGS through**
- **REducing WINDOW AREA**
- **REFLECTIVE PAINTING OF EXTERNAL WALLS AND ROOF**
- **ENERGY-SAVING LIGHTING**

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What is energy labeling?

**Energy Efficiency Labels are designed to provide accurate and comparable information on the energy consumption of electrical appliances.**

This helps consumers to identify more energy-efficient products at the time of purchase. Buying more efficient equipment, consumers can save money on their energy bills while reducing greenhouse gas emissions.

The energy label is the same for all products in each category, e.g., refrigerators, which makes all products comparable. The energy label classifies products from 1 to 5 according to the national standard, 5 being the most energy-efficient class, and 1 the least energy-efficient. All manufacturers that want to sell a product must follow a defined testing procedure and get the energy label for their product.

Energy labeling enables consumers to choose more energy-efficient products. At the same time, it also encourages manufacturers to drive innovation by using more energy-saving technologies. Manufacturers are keen to see their energy-labeled products in the highest available category when compared to competitors. Step by step, electrical appliances are becoming more and more efficient.

**Energy Labeling and Minimum Efficiency Standards for Household Devices are one of the most promising policy instruments.**

**How much money can you save?**

**Inefficient household**

- **Power:** 90 Watt
- **Consumption:** 187 kWh/year
- **Cost:** USD 35

**Efficient household**

- **Power:** 25 Watt
- **Consumption:** 52 kWh/year
- **Cost:** USD 10

- **Power:** 200 Watt
- **Consumption:** 1,022 kWh/year
- **Cost:** USD 189

- **Power:** 1,200 Watt
- **Consumption:** 3,942 kWh/year
- **Cost:** USD 729

Lighting, refrigerator and air conditioners are the major electricity consuming devices in a typical urban middle-class household of Cambodia. By replacing all devices in these categories by the most-efficient technology, each family could save up to 3,000 Kilowatt-hours of electricity and 545 US-Dollar in energy cost every year.

**MAJOR ENERGY CONSUMING EQUIPMENT**

- **Lighting**
  - All Lighting
  - Residential Refrigerators
  - Room Air Conditioners
- **Cooling**
  - Industrial Electric Motors
  - Distribution Transformers

**SAVING POTENTIAL**

Energy labeling and minimum efficiency standards for household devices are one of the most promising policy instruments. Introducing energy labeling for five appliance categories in Cambodia could result in 30% annual electricity savings in 2030.1 These savings would amount to US$ 280 Million savings in energy cost equivalent to the investment required for building two new power plants.2

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1 Compared to Business-as-usual scenario
More competitiveness through energy efficiency

Energy-efficient Industries

The industrial sector consumes about 22% of total electricity in Cambodia. Although power is expensive, it is wasted. Energy audits and assessments conducted by project interventions in factories have shown that enormous savings could be achieved. Energy management is not yet a standard practice in Cambodia’s industries due to a lack of awareness and knowledge.

But what is energy management? Energy management is well-planned actions that help an organization to reduce its energy bills and is crucial to promote energy efficiency in industries. The two main energy management strategies are conservation and efficiency. Energy management requires the establishment of a system of collection, analysis, and reporting on the industry’s energy consumption and costs. An energy audit is an inspection survey, and an analysis of energy flows in a building or factory with the objective to identify energy saving opportunities. Many energy saving measures are low-hanging fruits and require no or marginal investment. They are achieved by improving maintenance and optimizing operations. Upgrading of existing equipment by modern energy efficient equipment can improve the industry’s competitiveness by decreasing the energy intensity and, at the same time, the negative environmental impact.

What are the benefits of an industrial energy audit?

Comprehensive analysis of the energy use pattern in the factory

Identification of EE measures and calculated energy savings including economic feasibility

Opportunity to reduce production costs and improve the company’s competitiveness.

Benchmarking of industries by using the energy intensity to compare with other industries

The energy management cycle

1 ENERGY AUDIT
The energy audit is the first step of the broader journey towards improvement in energy performance.

2 PRIORITISE
Locate each EE intervention from your audit and prioritize to available resources and time.

3 PLAN & ASSIGN
Establish a project team and assign responsibilities. Set target and goal using feasible performance indicators.

4 IMPLEMENT
Implement simple operational EE practices first and larger scale priorities later.

5 STRATEGISE
Involve all stakeholders to develop long term plans for high-value improvement and long-term savings.

6 REVIEW
Periodic review and evaluation is critical to success. Return to step 1 or 2 to identify new saving opportunities.
MAXIMIZE ENERGY EFFICIENCY

One of the essential dimensions of the eco-industrial park is to maximize energy efficiency and ensure reliable and clean energy supply. This can be achieved through energy-efficient facility and factory design, co-generation, waste heat recovery, and real-time energy monitoring.

IMPROVED COMPETITIVENESS

The benefits for the industries are reduced production costs through increased material and energy efficiency, which leads to profit maximization. Industries will become more familiar with EE technologies and technique and, thus, improve their competitiveness.

ESCO Model

Small and Medium Enterprises (SMEs) in Cambodia have limited financial resources and cannot build up in-house technical capacity in energy efficiency. The ESCO approach could fill the gap and provide a viable solution for promoting energy conservation over the whole industrial sector.

An energy service company (ESCO) is a business that provides energy audits and implementation of energy savings projects. Most ESCOs include innovative financing methods that accept some degree of financial risk. The ESCO starts by performing an energy audit at the factory or building; then, it designs an energy efficient solution and installs the required equipment. The ESCO is often also responsible for maintaining the system to ensure energy savings during the payback period. The factory or building owner pays back the capital investment through the savings in energy costs. If the project does not provide returns on the investment, the ESCO is often responsible for paying the difference.

The phases of a typical ESCO project

1. **ENERGY AUDIT**
2. **PLANNING**
3. **IMPLEMENTATION**
4. **MONITORING**
Sustainable and Efficient transport

GLOBAL CO2 EMISSIONS FROM THE TRANSPORT SECTOR ARE PROJECTED TO INCREASE NEARLY 50% BY 2030. THIS MIGHT HAVE PROFOUND ENVIRONMENTAL, ECONOMIC, AND SOCIAL CONSEQUENCES UNLESS DRAMATIC CHANGES ARE ADOPTED.

Local Impact

Rapid motorization is creating more congestion, air pollution, and traffic accidents - especially in the urban centres of developing countries like Cambodia. It is estimated that traffic accidents cost Cambodia as much as US$337 million per year.1 Air pollution is also a significant health hazard contributing to respiratory diseases like asthma and the premature death of over 11,400 Cambodian every year.2

Solutions

Sustainable transport solutions are available. For better health, less noise and pollution, walking and cycling are near the top of what urban regions need. Therefore, it is necessary to create a good network of shady side walks and cycling lanes. Switching from fossil fuel-powered engines to electric vehicles has the potential to reduce global transport emissions by 35%. Electric vehicles together with public transportation can provide a cleaner solution for transportation in Asian urban centers.

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Energy Efficiency Policy

Where we stand now?

Cambodia is a booming lower middle-income country where the newly emerging middle class is adopting more resource-intensive life-styles. Consequently, electricity consumption per capita has risen sharply within recent years. The government is struggling to catch up with the power demand growth. The country-wide adoption of energy conservation and energy efficiency practices is essential to ensure a low-carbon development path. First initiatives have shown that energy efficiency does not only reduce carbon emission but also saves money in energy bills. The Royal government of Cambodia now has the opportunity to set the stage for transformation towards a more sustainable and energy-efficient society.

ACTION 1
Approve National Energy Efficiency Policy

Ministry of Mines and Energy (MME) developed the National Energy Efficiency Policy between 2015 and 2017. This policy is crucial to set the regulatory framework for government actions to promote energy efficiency. It targets three sectors: (1) Buildings, (2) Industry, and (3) Transport.

Relevant line ministries will be actively involved in the implementation of the EE policy.

ACTION 2
Conduct country-wide awareness campaigns on energy efficiency

The success of an energy efficiency initiative depends on people even more than technology. Comprehensive awareness and education programs are the key to achieving energy saving targets. The government shall lead by example and set the regulatory framework conditions. The private sector and NGOs need to play a significant role in sending the message to the broad public. Behavior change among private-sector actors can be motivated by workplace engagement programs, competitions, challenges, awareness campaigns, and other incentives that reward the best performers.

ACTION 3
Develop and enforce energy efficiency labels for appliances

MME is currently developing the Sub-decree on Energy Efficiency Labels. When enacted, energy consuming household devices like air-conditioners, refrigerators, and light bulbs can only be sold in Cambodia if they carry the Khmer star energy label. Energy efficiency labels provide consumers with information on the efficiency of a product. The regulation will also set minimum energy performance requirements to ban the import of inefficient appliances in the country.

ACTION 4
Integrate energy regulations into existing construction law

The MLMUPC launched the Construction Law in December 2019. This new law was urgently needed to address the regulatory gap of Cambodia’s booming construction sector. The construction of more energy-consuming buildings was partly responsible for the power outages in 2019. Integrating energy regulation into the construction law could slow down energy demand growth and reduce power cuts. Such laws set minimum efficiency requirements for new and renovated buildings, assuring reductions in energy use and emissions. The benefits of building users are lower energy bills.

ACTION 5
Establish an energy management and audit scheme

Many countries have set mandatory energy management and audit regulations for large electricity consumers such as garment industries, hotels and shopping malls. A national program for certified energy managers and auditors will be required to develop local knowledge. Energy management will not only save energy and money in industries and buildings but also create new jobs for the young Cambodian workforce.

ACTION 6
Enable incentives and financing for energy efficiency

Incentives and finance can help energy efficiency projects to overcome economic barriers, such as those related to high upfront costs. Incentives like grants and rebates, as well as tax incentives, help pay down some of the upfront cost of investing in energy efficiency. Non-monetary incentives, such as granting developers priority processing of permits or a greater allowed floor area, may be attractive to the private market while requiring little or no investment by the government. Green bonds, energy-efficiency credit lines, and risk-sharing facilities are possible financing solutions to drive the energy efficiency market in the country.

Benefits

Economic development: Energy expenditure makes up a significant share of a household or business budget. Increasing energy productivity through energy efficiency measures has the potential to slow the growth of energy demand in Cambodia. Each additional $1 spent on energy efficiency avoids more than $2, on average, invested in new power plants. Energy efficiency frees up capital for other strategic investments, helping the government face multiple competing demands for scarce financial resources.

Social benefits: Energy efficiency can stretch existing electricity resources further, helping to provide better energy access, reliability, and security. It will also help to keep electricity prices low and affordable. A more energy efficient transport sector reduces air pollution lowering the health risk for Cambodia’s urban population. Energy-efficient buildings are more comfortable and healthier; people working in a healthy environment are more productive. Establishing an energy efficiency market in Cambodia will create thousands of new jobs providing the country’s young workforce new income opportunities.

Environmental sustainability: Energy efficiency has tremendous potential to boost economic growth and avoid greenhouse gas emissions. Most of EE technologies are commercially available today, and many of them deliver positive financial returns within relatively short payback periods. In Cambodia, cumulative GHG emission savings from energy efficiency could amount to 48 Million tons in 2040. This is equivalent to 3 billion tree seedlings grown for ten years.

*Ministry of Land Management, Urban Planning and Construction
**Energy Saving Tips**

**Switch off**
Switch off lights, fans, air-conditioners, TV, and computers when not in use. Unnecessary operating household equipment consumes electricity that you have to pay at the end of the month. Also, avoid leaving TVs and other devices on standby mode by connecting them to a multiplug that can be switch-off completely. It is a myth that you will use less energy, leaving on the air-conditioner while you are not home. What you are really doing is wasting energy!

**Efficient Lighting**
Replace all incandescent by good-quality LED light bulbs. This pays back immediately by lowering your electricity bill. If you are using CFL bulbs, replace them by LED when they don’t work anymore.

**Replace old inefficient appliances**
Is your fridge or air conditioners at home older than 5 years? Then you can save a lot of energy when buying a new energy efficient appliance. The investment will payback in less than 1 year. Look out for energy labels stickers placed on new devices in the shops. Buy only 5-star labelled refrigerator, freezers, and air-conditioners, and you lower your electricity bill right now.

**Cool down with less**
Open windows and allow the breeze cool down your home early morning or during cooler evening hours. Natural ventilation is free of cost. Using fans are less expensive to operate and maintain than air-conditioners. But remember to turn off the fans when you leave the room. Fans cool people, not rooms.

**Cool down smarter**
During the hot season, the use of air conditioners (ACs) might be unavoidable to have a comfortable night. Set point temperatures between 26 and 28 degree Celsius create a comfortable indoor climate. You can save 3% of energy by raising the AC’s temperature by 1 degree Celsius.

During the cooler months, you might not require the AC running the whole night. When you go to bed, use the timer function that can switch off the unit after a few hours. In this way, you can save a lot of the money you spend on cooling down your home right now.

**Keep the heat outside and the cold air inside**
Close doors and windows when your air conditioner is switched on. Seal air gaps around doors and windows to reduce air leakage. Install solar screens, shutters or curtains and close to avoid that direct sun radiation heat up your home. The roof is responsible for a significant part of solar gains in hot climates. Paint your roof of light color, and you will save energy investing little money. Adding an insulation layer under the roof or on the suspended ceiling under the roof will keep the heat outside.

**Keep your AC clean**
Follow the cleaning schedule described in the manual of your AC equipment! Monthly cleaning of inside air filters allows the system to run efficiently. Split ACs must be cleaned by your technician every six months if you use them regularly.

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Save energy at your office

Running a business can be expensive, from employee salaries to maintaining the office building. Saving energy in the office can help reduce energy bills of your company or organization and reduce your contribution to greenhouse gas emissions. Here is a practical guide on how you can save energy in the office in several ways.

Switch off
Remind everyone in the office to turn off their electronics at the end of the day. It’s important that everyone also power down electronics when they are not in use. Contrary to popular belief, shutting off your computer at the end of the day will not shorten its lifespan and can save a lot of energy.

Reduce standby losses
Most appliances constantly use energy because of standby settings. These energy losses cannot be turned off without unplugging the device altogether. Although this may be true for some chargers, most chargers use “standby power” while plugged in but not connected to their device. The only way is to connect electrical appliances to a multiplug that can be switch-off entirely at the end of the day.

Smart and efficient lighting
Replace all incandescent and CFL bulbs by good-quality energy-efficient LED light bulbs. This pays back immediately by lowering your electricity bill. The easiest way to keep lights off when they’re not in use are occupancy sensors. Consider installing such sensors in bathrooms, staircases, and corridors where continuous lighting is not required.

Protect your windows from the heat
Many office buildings in Cambodia have large glazing areas to provide a modern look and good daylighting. Having your desk next to the window might be uncomfortably hot. Let in the light, not the heat by applying a sun protecting window film where direct sunlight shines several hours into your office. This will reduce the energy bill for your cooling system. You can also install shades, blinds, and other sun-blocking devices instead.

Energy saving tips

Use power management settings
On computers, printers, and other pieces of office equipment, use the recommended power management settings to shut them off or go into hibernate mode when technology is not in use.

Install a variable refrigerant flow (VRF) cooling system
For larger offices, we recommend the installation of energy efficient VRF cooling systems. This will not only reduce your electricity bill but also improve the thermal comfort and air quality in your office. Studies around the world have shown that a more comfortable working environment increases the productivity of your employees.

Install smart energy meters
Smart energy meters can display your electricity usage in real time, so you see exactly how much you’re spending on energy. Smart meters are becoming more popular than ever in offices — and they could help save you money. Brainstorm with your green team on new energy saving measures. Behavior changes can lead up to 20% of electricity savings at zero cost. Try out new energy saving strategies and see in real-time how much energy you save.

Regular maintenance for efficient cooling
Make sure that your HVAC system is cleaned and maintained on a routine basis. Follow the cleaning schedule instructed by the manufacturer of your AC equipment. A clean and working HVAC system will help to reduce your energy bills and make sure your employees feel comfortable.

Less energy for cooling
Close doors and windows when your air conditioner is switched on. Seal air gaps around doors and windows and apply weather stripping to prevent energy loss that drives up cooling energy bills. Operate the ceiling fan in conjunction with your air conditioner to spread the cooled air more effectively throughout the room and operate the air conditioner at a higher temperature. Changing your AC settings by as little as one degree Celsius could reduce your annual bill by up to 3%.

SET UP A GREEN DREAM TEAM
Engage your staff in energy saving and other sustainability challenges by forming a green team in your office. A green team is typically a few people that get together once a month and discuss ways to make the office eco-friendlier and reduce energy use. The green team might create an office policy to ensure all the lights in your office are turned off, including lights in bathrooms, kitchen areas, and meeting rooms. Join an energy efficiency competition and compete with another office in achieving energy savings. If everyone in your organization is aware about saving opportunities and changes its behavior accordingly, you can save up to 15% of your electricity bill.