Introduction

In the path towards becoming a sustainable campus, sustainable energy management is one of the key issues. To that end, a huge responsibility falls on our students, faculty, and staff. On campus, each individual is expected to take an initiative to support the University's "3R" campus energy management policy (Reduce-Reuse-Recycle) and take it one step further. This document is prepared as a guide to that end to ensure effective use of our on-campus energy and water resources.

The burning of fossil fuels, which are our primary energy resources, causes carbon emissions. Carbon Footprint is a measure of the impact human activities have on the environment in terms of the amount of green house gases produced, measured in units of carbon dioxide. There are two types of carbon footprints: direct/primary footprint and indirect/secondary footprint. The primary footprint is a measure of our direct CO_2 emissions from the burning of fossil fuels including domestic energy consumption and transportation, while the secondary footprint is the sum of indirect CO_2 emissions associated with the manufacture and breakdown of all products we consume. The ratio of carbon dioxide in the atmosphere has increased by 25% over the last 100 years. Scientists largely attribute the reason for climate change in recent years to this increase. Energy saving and efficient use of energy resources will help us reduce both carbon emissions and high energy costs. Energy efficiency can be defined as reducing energy consumption per unit service or product without compromising the level of comfort, service, or production. Studies conducted across the world reveal the substantial energy saving potential of the construction and industry sectors. Hence, developed countries place a higher focus in energy saving. In reducing the carbon footprint, energy efficiency is as important as developing new and alternative energy resources or technologies.

Through the Kyoto Protocol and Copenhagen Summit, the European Union aimed to reduce carbon emissions along with imported energy. To this end, the European Union (EU) has committed itself to a 20 % increase in the share of renewable energy, 20 % reduction of carbon emissions, and a 20 % improvement in energy efficiency by the year 2020. Kyoto Protocol is the only international framework to combat global warming and climate change. It was adopted as the first addition to the United Nations Framework Convention on Climate Change (UNFCCC). The signatories have pledged to reduce the emission of carbon dioxide and five other greenhouse gases, or, where that is not possible, to achieve their emissions reduction objectives through emissions trading. The protocol requires the parties to reduce their carbon emissions to 1990 levels. The protocol was signed in 1997 but only came into force in 2005. In 2009, the Grand National Assembly of Turkey passed and put into force a bill on the country's participation in the Kyoto Protocol.

In doing so, Turkey pledged to achieve the European Union's 2020 energy efficiency objectives within the framework of the EU Harmonization Process. To this end, the General Directorate for Renewable Energy published the "Regulations on Energy Performance in Buildings". Our University went above and beyond the requirements stipulated in these regulations with its LEED (Leadership in Energy & Environmental Design)-certified buildings and adopted an energy policy that relies on self-generated energy from clean energy resources. Also, the University employs a set of systems to manage energy performance, and on-campus energy consumption is managed centrally from the "Energy Distribution Center". Nevertheless, our campus still holds a great potential for further energy savings. Therefore, effective use of on-campus energy and water resources in all academic buildings and dormitory buildings across the campus is of paramount importance.

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Current Status of Campus Energy and Water Resources

Energy is used for a wide array of purposes on campus, from heating and cooling of the buildings to lighting and sockets. Energy must be managed wisely in academic buildings, in particular, in order to increase the performance of students, faculty, and staff to the optimum levels. To this end, several automation systems have been installed on campus. In addition to automated control, building occupants' awareness of the energy they consume on a day to day basis also helps save energy at least as much as the energy savings achieved through automation. Too cold or too hot buildings affect the comfort of building occupants. For this reason, energy must be used with maximum efficiency without compromising comfort parameters. Unnecessary operation of any device or system will result in inefficient use of energy. These actions not only lead to higher energy costs but also higher operational and maintenance-repair costs, and must be avoided at all times.

Green energy is used widely across our campus. The Faculty of Engineering (AB1), ScOLa, Faculty of Business (AB2), and Energy Distribution Center buildings accommodate a 380 kWh "Photovoltaic Solar Power System" on their roofs. Also, air inside the ScOLa building is heated with the "Ground Source Heat Pump" system. The EDC building accommodates a trigeneration system which is capable of simultaneous generation of electricity and heating and cooling, using natural gas as fuel. Natural gas first enters the turbocharger of the Gas Engine. Here, air and fuel is mixed at appropriate ratios, and this mixture, then, goes to the combustion chamber of the Gas Engine. In the combustion chamber, the chemical energy of the fuel is converted into mechanical energy. This mechanical energy is converted into electrical energy by the Generator coupled to the Gas Engine. Natural gas that enters the Gas Engine has a power generation capacity of 3,621 kW. It generates 1,560 kW of gross electricity in the Generator. When the Internal Energy Need of 140 kW is deducted from the gross generation, the net electricity generation will be 1,420 kW. The exhaust gases and jacket cooling water circuit (HT) of the Gas Engine are supplied directly to the ABS Multi Chiller. ABS Multi Chiller primarily uses the exhaust gases and, when necessary, the heat from the HT circuit, depending on the heat requirement (heating / cooling). The ABS Multi Chiller is capable to produce 266 m^3/h of cold water at 7 °C (1554 kW) (when the inlet water temperature is 12 °C) or 28 m^3/ h of hot water at 80 °C (650 kW) (when the inlet water temperature is 60 °C). The ABS Multi Chiller is cooled with a cooling water circuit and a cooling tower, wherein the inlet water is 35.8 °C / and outlet water is 30 °C. When cold water is not drawn from the ABS Multi Chiller, the system is capable to produce 36 m^3/h of hot water at 80°C (841 kW) via the HW (Hot Water) circuit (when the inlet water temperature is 60 °C) through the plate hot water exchanger. 6 m^3 /h of warm water (137 kW) at 40 ° C can be taken from the intercooler cooling water circuit (LT) of the Gas Engine via a plate exchanger (when the inlet water temperature is 20 °C). Meanwhile, the mains electricity of the campus is supplied by clean electricity generated entirely from wind power. The campus accommodates LEED GOLD certified buildings, and all on-campus buildings are designed according to the following sustainability criteria:

Environmental Use:

- Maximum use of landscape with local and adapted types of plants
- Mitigation of heat island with high-albedo materials and green roofs
- Easy access to public transportation via shuttles
- Parking facilities and charging stations for electrical and hybrid vehicles
- Measures to reduce light pollution

Water Efficiency:

- Rainwater and greywater management and reuse system
- High-efficiency faucets
- "Dual-Flash" toilets
- Plants suitable for drip irrigation

Materials and Resources:

- Maximum recycling of waste construction materials (Goal. 10%)
- Recycling bins placed all over the campus
- Use of local construction materials for campus construction (Goal: 30%)
- Choosing certified materials as much as feasible,
- Detailed design features for spaces with high human traffic
- Selection of durable materials to minimize the life cycle and reduce maintenance cost

Energy Efficiency:

- An energy efficiency structure with a 20% better performance on average as per the ASHRAE 90.1 standards
- High-efficiency chillers and cooling towers
- High-efficiency and low N0x-emission boilers
- “Free Cooling” system which makes maximum use of the difference between indoor and outdoor temperatures
- Heat recovery system
- Enhanced building and resource management system
- Environmentally friendly refrigerant selection
- High-efficiency lighting system using T5 fluorescent lamps and LED lighting
- A more efficient lighting quality than that of the ASHRAE 90.1 standards
- Indoor and outdoor lighting design in compliance with EN 12464
- Presence sensors placed in suitable places and maximum use of daylight
- Digital lighting automation system
- Enhanced activation and training procedure for technical staff

Indoor Air Quality:

- A 30% better airflow and a natural ventilation system as per the ASHRAE 62.1 standards.
- High-efficiency, F7-filtered, dedicated fresh air circulation units in spaces with mechanical ventilation systems
- Thermal comfort levels in compliance with the ASHRAE 55 standards
- Acoustic compliance
- Smoke-free zones within and around buildings
- Use of low VOC-emission materials in construction
- Regular measurements for Legionnaire's risk assessment

The measures you will take to save energy and use energy efficiently throughout the campus will ensure that the work carried out so far by our campus energy management unit will yield successful results. Meanwhile, your comments and suggestions will be carefully evaluated and swiftly put into action. You may send your comments and suggestions regarding the use of campus energy and water resources to our campus energy management unit via hse@ozu.edu.tr. You may also refer to the resources available on the campus sustainability website.

SMART CAMPUS - SMART CONSUMER

Electricity Use

❑ Lighting

Lighting is one of the primary energy-consuming systems in our campus buildings. The architecture of our campus buildings is designed to make maximum use of daylight. In addition, occupancy (“presence”) sensors connected to the lighting automation enable to turn off the lights in shared spaces when not in use. Illuminance, on the other hand, is automatically adjusted according to the data obtained from the lighting sensors in the spaces, and is kept at a level to provide the optimum working conditions under all circumstances. In addition to the automation system, lighting can also be controlled with manual interventions.

Illuminance: The amount of light falling on a surface is called illuminance. The unit of illuminance is the Lux. 1 Lux = 1 lumen / m2. The outdoor illuminance varies between 2,000-100,000 lux during the day and 50-500 lux at night.

The required illuminance values for some workplaces and works stipulated in the standard TS EN No: 12464 Light and Lighting - Lighting of Work Places - Part 1: Indoor Work Places " are given in the table below:

	Illuminance (Lux)
Hallways and Storage Areas	100
Offices	500
Surface Preparation and Painting	750
Assembly, Quality Control, and Color Inspection	1000

Illuminance as per the Standard TS EN 12464

Especially in offices and dormitory rooms, turning off the lights when not needed or when the units are vacated is extremely important for lighting savings. While everyone is well-aware of the savings that can be achieved by turning off the lights when not in use, there is a general lack of awareness of the extent of these savings. If everyone on our campus can prevent unnecessary use of lighting for 2 hours each day, we can achieve 75 Mega Watts of savings (in 2013 values), which corresponds to 25,000 TL per year.

What can we do?

- Turn off the lights when not necessary,
- Adjust the shades on the windows to make maximum use of the daylight,
- Turn off the lights in the spaces when not in use,
- Avoid using decorative lighting fixtures that consume too much energy,
- Designate a staff member to turn off the lights not automatically turned off by the automation system after the working hours,

- Automatically reduce the illuminance of the lights by dimming in order to make maximum use of the daylight,
- If only a certain part of an office is being used, turn on only the required number of lights,
- Put labels on the lighting switches to identify which switch operates which light in the unit,
- If there are very few people in the room you are in, try to use desk lamps,
- Report any malfunctioning or flickering lights to the campus energy management unit.
- Notify the staff in charge of any area where the automation system does not work properly,
- Notify the staff in charge of any outdoor lights left on during the day,
- Be sure to use energy efficient LED lamps.

❑ What's what? How Much Can I Save?

- If all houses in Turkey used an energy efficient lamp instead of a fluorescent lamp, we could close down a 2,000 MW power plant.
- It is an urban legend that the amount of energy we spend turning the lights on and off is higher than that of leaving them on. Turn off the lights wherever necessary without hesitation.
- Leaving the lights on in an empty seminar room overnight is equivalent to heating water for 1,000 cups of coffee.
- The changes we make in our habits for lighting savings will enable us to save 9-30 kWh, which amounts to to 3 - 10 TL per square meter per year.
- Using electronic ballasts instead of mechanical ballasts provides 30% energy saving.
- LED lights are 10 times more efficient and last 10 times longer than compact fluorescent lights.
- Fluorescent lights are considered hazardous waste because they cause harm to the environment and human health with the mercury and similar heavy metals they contain.
- The heat emitted by LED lights is 25 times lower than the heat emitted by compact fluorescent lights.

DO NOT COMPROMISE ON OCCUPATIONAL HEALTH AND SAFETY STANDARDS TO SAVE ON LIGHTING !!!

Computers and Other Office Equipment

Despite the fact that each office equipment uses a very small amount of energy on its own, when we calculate the annual energy consumption of equipment used in all offices across the campus, we encounter with an alarming figure. In addition to the energy they waste, unnecessarily use of office equipment not only does increase the load of the cooling system but also negatively affects the working comfort due to the heat they emit. Shutting down computers when not in use may not always be a practical and sufficient solution on its own. However, it should be known that leaving the monitors on when not in use will result in unnecessary energy consumption, corresponding to 65% of the total energy used by all computers across the campus. Even a computer in standby mode consumes a substantial amount of electrical energy that cannot be overlooked. Therefore, if possible, unplug our computers while shutting them down.

In new generation computers, there are smart software programs that either shut down the computer or put the computer in a low-power sleep mode when not actively used for a specific period of time. This feature must be activated in the power saving menu.

According to the statistics, 70% of the computers in the offices and dormitory rooms on university campuses are always left on. Turning off computers when not in use will yield a 20% saving on the total energy consumption of all office equipment.

When an average vending machine is operated 24 hours a day, it consumes 1,200 TL of electrical energy per year. Shutting down vending machines at night and on weekends can reduce carbon emissions by approximately a ton per year.

Tea or coffee machines use one third of the energy used by kettles. On the other hand, some water heaters consume 50% more energy in standby mode compared to their normal use. Therefore, due caution must be exercised when purchasing water heaters for offices.

What’s what? How can I save?

- A desktop computer that is kept on all day consumes 200 TL of electricity per year, which corresponds to 716 kg of carbon emissions per year.
- Leaving a computer monitor on overnight is equivalent to the energy used to laser print 800 sheets of A4 paper.
- Monitors amount to 65% of the power consumed by computers. Screen savers are not a solution for saving energy.
- Always be sure to shut down computers, printers, photocopiers and other office equipment at the end of the working hours and on weekends. Turning off monitors alone is not enough to save energy. Devices should be turned off with the main power button and should not be left on standby.
- If it is practical for you, save your work and shut down your computer during lunch breaks.

- If you will not be using your computer for a certain period while working in your office or dormitory room, turn off the main computer and additional monitors connected to it.
- Do not use additional monitors unless necessary.
- Be sure to turn off both the computer monitor and the computer case.
- Do not leave LCD monitors and projectors in standby mode. This will both reduce the operating life of the device and waste energy. In standby mode, a color LCD monitor continues to consume 24% of the energy it normally uses when in active mode.
- When purchasing or renting office equipment, energy efficient alternatives must be opted.
- Each office should designate volunteering employees who will periodically take turns to turn off electrical devices at the end of the working hours.
- Water dispensers and fridges used in offices should be turned off if they will not be used for a long time.
- Mini fridges in offices should be set to the lowest cooling setting possible.
- Fridge doors should be kept open for as short a time as possible.
- In offices, microwave ovens should be opted to heat food whenever possible.
- Kettles should not be filled with water completely, and instead should be operated with only the required amount of water.
- Smart plugs or digital plugs with timer function should be used to turn off devices automatically when not in use.

Device	Average Power Consumption (W)	Standby Power Consumption	Consumption Rate (%)
PC and Monitors	120	30-40	25
Laptops	40	20-30	50
LCD Monitors	80	10-15	12
Laser Printers	90-130	20-30	20
Photocopiers	120-1000	30-250	25
Vending Machines	350-700	300	50

Average power consumption of devices in active and standby mode

TURN OFF WHEN NOT IN USE!!!

❑ Heating & Cooling

Most buildings are equipped with mechanical automation systems to provide optimal comfort conditions. On our Çekmeköy Campus, automation systems are controlled via the main management panel in the Energy Management Center to ensure that the heating, cooling and ventilation systems operate in the most efficient way.
In addition to the automation system, it is of paramount importance that building occupants also check whether or not the heating-cooling systems waste any energy and be aware of all the systems operating in their environment.

❑ What's what? How can I save?

- Unnecessary heating or cooling of unused areas is one of the main sources of energy loss. Building usage trends should be analyzed very carefully and systems kept on unnecessarily should be reported.
- If the office or room temperature is too high, the indoor temperature should be reduced by local control mechanisms instead of opening windows.
- Reducing the heating temperature by 1 °C or increasing the cooling temperature by 1 °C will result in 8% energy saving.
- Doors and windows must be closed while the heating system is on. Doors and windows that cannot be closed properly or are left open should be reported to the staff in charge.
- Appropriate clothing must be worn to ensure that the heating system can be set to a few degrees lower.
- The use of portable electric heaters in offices should be avoided.
- Heating and cooling panels should not be covered with any cover or equipment.
- Buildings with artificial ventilation systems consume twice as much energy as those using natural ventilation systems.
- Keep the windows and doors closed in areas where the ventilation system is on.
- Make sure that the heating and cooling systems are not working simultaneously.
- Use the occupancy (presence) sensors in the rooms to ensure that only the rooms in use are heated/cooled.
- Smoking indoors in shared areas and faculty offices requires the evacuation of the air inside, which results in higher energy consumption as it increases the ventilation load. Windows opened to evacuate the air inside reduce the quality of the conditioned air inside. Therefore, do not smoke indoors.

THE GREENEST ENERGY IS SAVED ENERGY !!!

Water Usage

The unit cost of water and waste water used in the University's buildings is quite high. In particular, unnecessary use of hot water is a waste of both water and heating energy.

What's what? How can I save?

- A faucet that leaks a droplet a second will result in water loss of 4.1 liters a day (corresponding to 12 cups of coffee), 1,533 liters a year (corresponding to the daily average water consumption of 11 people). Any leaking faucet or faucets with malfunctioning sensors must be reported.
- Sinks are equipped with aerators that mix the running water with air at certain ratios to increase its flow rate.
- Making 1,000 liters of domestic water usable and passing it through wastewater treatment processes after use cause 404 kg of carbon dioxide emissions.
- Instead of taking long showers in dormitory rooms, residents must try to take shorter showers.
- External irrigation systems should not be left on unnecessarily, and any sprinklers or hoses working unnecessarily should be reported.
- Only the required amount of water should be boiled in kettles.
- The tap should not be left running while brushing teeth.
- Water too hot must be reported.
- Pouring liquids such as oil down the drain creates a huge burden on treatment facilities.
- When washing vegetables and fruits in the dormitory kitchens, they should be washed in a bowl, not under running water.
- Washing machines and dishwashers must be started when they are full.

WATER IS THE FUTURE. DON'T LET OUR FUTURE DRY UP!!!