Turning “Campusiology” into a Friendly Green City: University of Petra Case (UOP)

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Introduction:

The university is the center of creating knowledge and transfer of technology. It has to develop its campus as an enduring environment of quality learning, relevant teaching and research with outcomes serving to serve the society with creative thinkers, entrepreneurship and innovation.

The university (UOP) has designed a strategy to convert its campus into eco campus friendly with the environment, and change its traditional outset to a smart campus efficient in utilizing the space and creating a humane environment for the physical infrastructure to interact favorably with students and staff. The following criteria were selected for immediate action.
I. Shift to savings in electricity consumption:

The first step was taken to change all bulbs for lighting the university campus, teaching halls and classrooms, labs offices street lighting to LED.

The second step was to procure electrical appliances, air conditioners characterized by power-saving, and replace outdated, to power-saving.
II. Shift to renewables:
II. Shift to renewables: (continue)

The annual electricity consumption of UOP was 3,177,764 K.W. the electric bill cost was rising to $1.3 million/yr. Electricity in Jordan is expensive because 93% is generated by imported fuel-oil and the price is elevated according to increase of consumption, to a price of 45 ¢/ per K.W.

Also, consumption of fossil fuel would increase the release of gases (co2) to the atmosphere, causing pollution and greenhouse effect and contributing to climate change.
II. Shift to renewable: (continue)

So a policy was set to shift all electrical power to renewables-solar energy $1.5 \text{ M.W.}$ panels with total number of $5,523$ panels which were installed on the roofs and parking lots of total area of $30,000 \text{ m}^2$. Also, net meterings were installed with the main-grid through three substations supplying power to the university with inverters of DC to AC. Scada program was also installed to connect output of the solar energy panels to a control room at the computer & information center.

The saving by introducing solar energy into the system was enormous, where the UOP annual production of solar energy was $2,845,862 \text{ K.W.}$ which subsidized the UOP annual consumption of $3,177,764 \text{ K.W.}$ from the grid to reduce the balance to $331,902 \text{ K.W.}$ with an efficiency of $95\%$. 
II. Shift to renewable: (continue)

A plan is underway to increase the output of solar energy to 3.5 M.W. by installing more panels on roofs and new parking lots, to take care of UOP expansion of new buildings in Engineering, Medical Sciences, and others.

Staff and students were also happy not only with full lighting the campus and converting buildings to air conditioning, but also by having their parking lots and public transport roofed with solar panels to avoid the blazing-sun particularly in summers.

<table>
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<tr>
<th>Total PV production:</th>
<th>Total consumption:</th>
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<tr>
<td>2,845,862 K.W</td>
<td>3,177,764 K.W</td>
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Power system capacity: \((336.6 + 1,260.9) = 1,587\) K.W

Total number of solar cell panels: \((1,320* + 4,203)** = 5,523\) K.W

- \(255\) W (capacity) x 1,320 (parking) = 336.6 K.W.
- \(300\) W (capacity) x 4,203 (UOP) = 1,260.9 K.W.
III. Water and recycling:
III. Water and recycling: (continue)

Jordan is considered one of the most water stressed countries in the world. The amount of rain-water fall on UOP campus is around 400 mm per year. UOP has its water-well underground from the surface aquifer 350 m depth, recharged as surface aquifer by annual rainfall. The water is a healthy water, sufficient to the consumption of the university, but not enough to irrigate the greenery of the campus.

Therefore a policy was set to optimize the water consumption and to recycle the water through a recycling station of 200 m³/day built on the lowest spot of the campus to collect all waters through sewage piping by gravitation.
III. Water and recycling: (continue)

The recycled water was then pumped to reservoirs on the highest spots of the campus to irrigate all lawns, gardens, shrubs and trees through drip-irrigation to maintain a green campus. The university is in the process of building 50,000 m$^3$ reservoir under the stadium which is located in the lowest spot of the campus, to harvest rain-water by gravitation.

This will allow also implementing the greenery landscape designed by student of UOP at the airport road adjacent to the campus.
IV. Rehabilitation of infrastructure and architecture:
IV. Rehabilitation of infrastructure and architecture: (continue)

Policy was set to rehabilitate old buildings to save on heating in winters and cooling in summers through insulation and restructuring the electromechanical restructuring toilets with good ventilation and provide student lounges to avoid noise pollution and create friendly environment.

All new buildings, have followed a strict criteria of good insulation and ventilation. Shaded pergolas were provided throughout with kiosks to provide snacks and refreshments and create an atmosphere for students to develop friendly dialogue.
V. WiFi and Internet:
V. WiFi and Internet: (continue)

The campus is covered with 180 MB. free wireless internet and fiber optics cables covering all offices, labs and classrooms where students and staff utilize for access to knowledge and information. Also, students buses are provided with free WiFi.
VI. Free-smoking campus:

The campus is free-smoking, but students and staff are not adhering with the rules. Therefore, the university is providing special rooms, for smokers with forced ventilation.
VII. Camera-controlled campus against abuse:

750 Camera are controlling the campus entry and exits and public places to control abuse linked to central control at the computer and information center.
VIII. Free-parking campus:
VIII. Free-parking campus: (continue)

The university is a walking campus for safety of students and staff. The university is providing free parking for students of 1,000 cars in six story building and in the process of providing under the stadium 3,000 cars of smart-parking, well ventilated.

Vehicles will be confined to the ring road circulating the campus buildings from the outset and provided with parking covered places for the staff. Electrical carriages will serve the students to reduce emission of CO2, for easy transfer from a building to another by using the ring-road.
IX. Central-controlled system:
IX. Central-controlled system: (continue)

**PV SCADA System**
IX. Central-controlled system: (continue)
IX. Central-controlled system: (continue)
IX. **Central-controlled system**: (continue)

All cameras and smart card and car magnetic stickers are reported to a centrally-controlled room at the computer and information center.

Where entry and exit of the campus are monitored.
X. Smart card for entry and using free services and facilities:

The smart magnetic card will be provided to all students upon registration to monitor attendance of classes and events and will monitor entry and exit of all students and staff of the campus.
UOP is moving forward toward achieving a smart green campus to provide an environmentally friendly ecosystem, supporting excellence in learning and research. It is ranked now in the 3rd place in the greenmetric university ranking of Jordan.
my motto:

ICID
Initiate, Create
Innovate, Disseminate

Thank you For Listening