

# EE Undergraduate Researcher Visit to KFUPM Research Institute (RI): A Storytelling by EE490 Students

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## Introduction:

Advancements in countries are measured with their capabilities to produce, invent, and discover new phenomena. These advancements are the outcomes of extensive and continuous research and development, achieved by the universities and research institutes. On Tuesday 20/2/2018, we had a class activity EE490 (Undergraduate Research) with Dr. Ali Muqabel to visit the Research Institute (RI) of King Fahd University of Petroleum and Minerals (KFUPM). The objective of this activity was to understand and learn more about research methods, techniques, labs and to see the environment that researchers are working in.

The purpose of this storytelling is to summarize our visit to the RI, and to get introduced to some of the research facilities in the university. We passed through about 5 segments in our visit to RI (Building 15).

**First:** Meeting the Vice Rector for Graduate Studies and Scientific Research, Dr. Sahel N. Abduljawad

He greeted us with a very welcoming and a warm smile. Then he started out with the advancements in research globally and its importance to humanity and the Kingdom. He added that KFUPM is the leading university in Saudi Arabia regarding its numerous outcomes in different fields whether it was domestic or international, and it would be categorized as a research university according to the Minister of Education. In addition, big companies like Saudi Aramco and STC would make contracts with the university to perform their desired tests and research advancements, to solve real business problems they face.



The university is seeking to include undergraduate students more in the research field rather than graduate students only. The Vice Rector also listened to the input from the students about their experience. Finally, he encouraged us, the undergraduate students, to take good advantage of the research facilities prior to graduation, and he is hoping to see us produce results.

**Second:** Materials Lab

There were several labs that were focused in the field of Material Characterizations. The first lab we entered had a very expensive device, called Transmission Electron Microscope (TEM). It could magnify a dry liquid or solid sample up to 100,000 times the original size by using a 200kV electrical beam. We can see atoms!

Then there was another -expensive- device, named Scanning Transmission Electron Microscope (STEM) that would show the atomic scan of the tested materials. It takes pictures of the desired sample, and then the characteristics of the atoms can be used to identify them. For example, if you sample a human's flesh, the STEM would show that it is constructed from Carbon and other stuff.



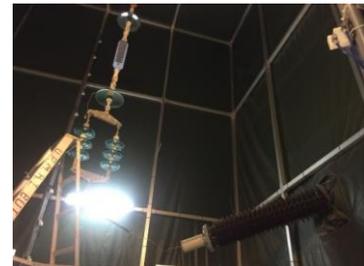
Then we moved to another lab where it had five individual machines, used for the same purposes as the STEM and the TEM, but using different techniques. Two of them worked on defining the elements of the compound, and the other three worked on defining the elements based on wavelength criteria.



They also have other devices, like the Field Effect Microscope (FEM), and the Atomic Force Microscope (AFM).

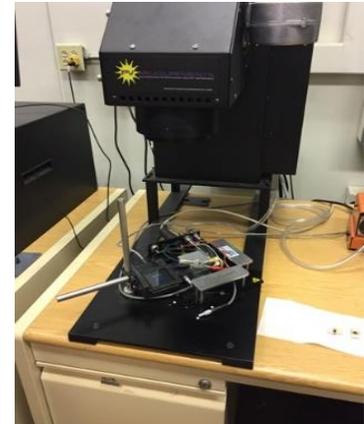
### **Third:** Petroleum Lab

We visited Petroleum Lab where they perform computed tomography (CT) scans, but they scan rocks instead of human bodies!



### **Forth:** High Voltage Lab

This lab is located in the basement, where they test very high voltage equipment -usually insulators-. The voltage is very high to the point where air becomes conductive, and people can't stay close to the test area! They coordinate with Saudi Electrical Company to cope with the power suction of the tests.



### **Fifth:** Renewable Energy Center

We visited Renewable Energy Center which was established in 2008. They develop and test Photo-Voltaic (PV) cells there, composed of different materials and compositions in order to produce a product with a high efficiency and adequate to the Saudi Arabian harsh climate. This lab also studies dust properties and cleaning dust effects on PV. They are equipped with a device that simulates the actual working condition for the cells and it has a light intensity to emulate the sun.

### **Sixth: Communication and Signal Processing Lab**

The Communication Lab sponsored Ericsson and supported by STC has equipment to run a full physical communications system, from the servers, and base station, the antennas, till the cellphones. It is ready to run and test 5G, and by default, the older technologies.

At the end, we concluded by learning about other research centers activities within the institute that we didn't have the chance to visit such as Nanotechnology Lab, Corrosion and Petrochemicals centers. The six main RI centers are: Communication & IT., Economics & Management, Engineering Research, Refining & Petrochemicals, Environment & Water, and Renewable Energy.



### **Conclusion:**

This report demonstrates different stages we have experienced in the Research Institute. Such a visit was a great backup for us in terms of many aspects. We developed our knowledge about many devices that does great experiments in various research fields. We have also expanded our research background through the visit to labs that are related to our research interests. The meeting with the Vice Rector was a great motivation to undergraduate researchers.

We have seen and lived the environment of the researchers, which has surely motivated us in our research work. In general, it was more than an advantageous experience.

We ended our visit with some refreshments and we thanked our visit guide for his efforts in making our visit easier and more beneficial. Even though we have spent around two hours roaming the building, it wasn't enough to see everything. We should come and visit it again for a longer duration.

