

WELCOME ADDRESS

It gives me great pleasure to welcome you to the second edition of the KEEP Bulletin.

This Newsletter aims to share information, news, stories and documentation on the KEEP journey towards strengthening postgraduate education at the College of Engineering (CoE). In this edition, we bring you the various meetings, field visits, innovations and workshops that have taken place at the CoE.

KEEP aims at strengthening relationship with alumni and as such, has developed a form for our cherished alumni to fill out. The information will be used strictly for keeping a database of our alumni, for easier and richer collaborations.

Please follow the link (<https://forms.gle/xnPsNCJXDC28s7kU8>) to complete the google form on basic biodata; this should not take more than 2 minutes of your time.

We welcome contributions and suggestions from stakeholders and readers to help improve future editions. Please send contributions and suggestions to keep@knust.edu.gh.

Cheers!

Prof. Kwabena Biritwum Nyarko
(Project Lead, KEEP)

Maiden Meeting of The International Scientific Advisory Board Held

The maiden meeting of the International Scientific Advisory Board was held on 25th June 2020.

Prof. Kwabena Biritwum Nyarko, the Project Lead for KEEP gave an exhaustive presentation on the genesis of the College of Engineering (CoE) and KEEP. He said the School of Engineering was established in 1952 with three (3) Engineering programmes (Civil, Electrical and Mechanical Engineering). He said the CoE which is now one of the six (6) colleges created in 2004 by KNUST now runs eighteen (18) different Engineering programmes at the undergraduate level and over thirty (30) programmes at the postgraduate level. The Project Lead stated that postgraduate enrolment constitutes about 8% of student population at the CoE. He further said the vision of the CoE, as captured in the CoE Strategic Plan (2016-2025), is to become Africa's leading College by 2025. This would be achieved by increasing postgraduate enrolment and improving the quality of education.

The Project Lead stated that the KNUST Engineering Education Project (KEEP) is one of the Africa Centers of Excellence (ACE) for Development Impact, an initiative of the World Bank to address the shortage of high-level skills and applied research in Ghana and the sub-region. He outlined the objective of KEEP as, to expand access to high quality engineering postgraduate programmes, conduct and disseminate international calibre applied research focused on addressing developmental challenges related to industrialization, energy and digital development.

He further briefed the Board that the Project, with a duration of five years (2019-2023), is a result based one with the capacity to access a maximum amount of US\$5.5m if all indicators, referred to as

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Disbursement Linked Indicators (DLIs), are met.

He gave the breakdown of the budget as follows:

1. **DLI 1 Readiness (Basic and Full) – (US \$850,000):** Establishment of a project team, Industrial Advisory Board (IAB) and International Scientific Advisory Board (ISAB), and development of an Implementation Plan.
2. **DLI 3 Quantity of students enrolled, with focus on gender and regionalisation (US \$1,035,000):** 75 PhD and 100 MSc graduates trained by the end of the five (5) years.
3. **DLI 4 Quality of Education and Research – (US \$1,400,000):** GAP Assessment, Infrastructure (building and laboratories), and Accreditation (national and international).
4. **DLI 5 Relevance of Education and Research - (US \$1,775,000):** Tuition and other student fees, research consultancies, fundraising and competitive grants.
5. **DLI 6 Timeliness and quality of fiduciary management (US \$440,000).**

Prof. Nyarko informed the ISAB Board members that the members

of the Industrial Advisory Board, at a meeting held in November 2019, were particularly concerned about forging strong relations with the alumni, and had pledged their support in making the project a sustainable one.

On student enrolment numbers for the 2019/2020 academic year, Prof. Nyarko informed members of the Board that 118 students were admitted onto KEEP related programmes, 81 of whom were admitted to read Masters programmes and 37, PhD programmes. He indicated that as at June 2020, 23 applications had been received for PhD programmes and 75 for Masters programmes. Out of these numbers, 28 are international applicants, which the Board found to be very encouraging.

The quality of education and research would be enhanced through national and international accreditation of the academic programmes, and the construction of a postgraduate building with lecture halls and laboratories. A number of proposals, aimed at further enhancing the quality of engineering education, had also been submitted to funding agencies for consideration.

Measures to ensure the sustainability of the Project would include the establishment of

an endowment fund, research grants, contract research from industry and tuition fees.

Board members suggested that Research Labs should be a priority in the College of Engineering postgraduate building. The Labs should be assigned to specific faculties and equipment in the labs kept well. They also suggested capacity-building for faculty members in the area of digital development technologies and requested for presentations by the research thematic leads so that they can be abreast with the research direction of the various thematic areas.

The Terms of Reference of the ISAB Board Members, as spelt out by the Project Lead, were wholeheartedly accepted.

Board Members who participated in the meeting were Prof. Albert Ebo Richardson, who is the Board Chairman, Prof. Johnson Asumadu, Prof. Muyiwa Sam Adaramola, Dr. Richard Okine and Dr. Joseph Odartey Cruickshank. The KEEP team comprised of Prof. Kwabena Biritwum Nyarko (Project Lead), Prof. Jerry John Kponyo (Deputy Project Lead), Mr. Kwadwo Nyantakyi Marfo (Project Manager) and Mr. George Asante (Project Accountant).



International Scientific Advisory Board Members

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2ND MEETING OF THE INDUSTRIAL ADVISORY BOARD HELD



A cross-section of some members of the Industrial Advisory Board together with KEEP management

The 2nd meeting of the Industrial Advisory Board came off on 11th July 2020. The Project Lead, Prof. Kwabena Biritwum Nyarko updated members of the Board on activities that had taken place since the maiden Industrial Advisory Board meeting held on 8th November 2019. The main areas covered in his report were as follows:

Student enrolment on KEEP

In a presentation, Prof. Nyarko informed the Board that as at July 2020, twenty four (24) candidates had applied to read PhD programmes and ninety (90) candidates had applied to read Masters programmes. He further stated that out of the number that applied, thirty-five (35) were international applications, comprising of 11 PhD and 24 Masters candidates, from Nigeria, Gambia, Ethiopia, Uganda, Tanzania, Cameroon, Burkina Faso and

Benin. Application deadline was to be 31st August 2020 .

Additionally, he revealed that seven (7) Faculty Members from the Gambian Technical Training Institute have enrolled at the College of Engineering to undertake PhD programmes in Electrical, Civil and Mechanical Engineering.

Further to this, Prof. Nyarko outlined some strategies that have been put in place to attract more International Students onto the KEEP programme, stressing on its importance to the success of the Project as one of the major Indicators used in assessing it. The strategies include

- leveraging the network of African Centres of Excellence (ACEs) in the sub-region to advertise programmes offered by the College of Engineering;

- identifying and liaising with strategic academic partners in the sub-region;

- using international undergraduate students enrolled in the College as marketing and publicity ambassadors for the College and

- making the KEEP Project visible on social media handles such as Facebook, Twitter and Instagram.

Enhancing and expanding access to quality education

One major objective of KEEP is to expand access to, and enhance the quality of postgraduate education and research in Ghana and Africa. To this end, the Project Lead said that the National Accreditation Board had assessed the course curriculum and was yet to submit its feedback. With respect to enhancing the quality of postgraduate education, he mentioned that building plans for construction of a

postgraduate facility for teaching and research purposes had been completed. He proposed that a call for submission of tender for construction of the building be advertised in the Daily Graphic by the end of the month. In relation to International Accreditation of the KEEP postgraduate programmes, he pointed out that discussions had been held with the Agency for Quality Assurance (AQAS). AQAS is an independent non-profit organization dedicated for the accreditation of higher education institutions. It is located in Germany.. International Accreditation of programmes is a major milestone to be undertaken under the Project.

KEEP Internships

The Project Lead informed the Board that a proposal on the Intra-African Mobility Scheme had been submitted to the European Union (EU). He reported that KEEP had partnered with Germany, Rwanda, South Africa and Kenya in writing the proposal. He stated that in spite of the COVID-19 pandemic, KEEP had been able to secure some slots for its students to have online internships. He further solicited the help of members of the Board to secure more internship placements for students via online

means. Members readily agreed to support the process.

The Board members were of the view that the one-month internship period was too short to enable students learn much from industry. They therefore proposed that private institutions must be rolled in, and Memorandums of Understanding signed with them, to obtain a commitment to admit a specific number of students each year for industrial training in their organisations. The Board members further emphasised that solely depending on Government agencies for internship slots would be problematic since the College of Engineering, KNUST would be competing with so many other Universities.

The members also proposed that the College of Engineering explore avenues to introduce Cooperative Education, a structured method of combining classroom-based education with practical work experience, into the programme structure. They stated that cooperative education provides academic credit for structured job experience. This they believe would make students industry-ready after graduation.

KEEP beyond 2023

Prof. Nyarko stated that it is very imperative that measures are put in place to ensure the sustainability of the Project beyond the five-year duration (2019-2023). Some of such measures, he said, include the establishment of an endowment fund, research grants, leveraging on Alumni support, contract research from industry, and payment of tuition fees.

The Industrial Advisory Board members who participated in the meeting were Ing. Asare-Yeboah (Board Chairman), Mrs. Patricia Obo-Nai, Dr. Ben K.D. Asante, Dr. Kwaku Aning, Dr. Victor Atiemo-Obeng, Ing. William Amuna, Nana Akua Brenya Boateng (Board Secretary). The KEEP team comprised of Prof. Kwabena Biritwum Nyarko (Project Lead), Prof. Jerry John Kponyo (Deputy Project Lead), Mr. Kwadwo Nyantakyi Marfo (Project Manager) and Mr. George Asante (Project Accountant).

College of Engineering to Establish An Endowment Fund

The Deputy Project Lead, Prof. Jerry John Kponyo stated that to ensure the quality of engineering education in Ghana, the establishment of an endowment fund is very crucial. He made this known at the 2nd Industrial Advisory Board meeting of KEEP. In his presentation he said the rationale for the establishment of the fund is that tuition fees for national students, which are regulated by the Government, are relatively low. Additionally, Government subvention to the University has been decreasing over the years whilst student enrolment has been increasing, thereby creating a funding gap. He said this has led to a situation where it is difficult securing slots from Government for additional faculty members to be employed. This has therefore led to a student: staff ratio of 37:1 which is in excess of the required norm of 20:1 set by the National Council for Tertiary Education (NCTE).

Prof. Kponyo said the major objective of the fund would be to provide a stable and predictable funding for the College of Engineering to enable it become an internationally acknowledged Centre of Excellence in Engineering education, producing high-calibre graduates with knowledge and expertise to support the industrial and socio-economic development of Ghana and Africa.

Specifically, the fund would seek to:

- improve the quality of postgraduate programmes;
- expand access to postgraduate programmes;
- provide scholarships to attract brilliant post-graduate students; and
- improve infrastructure to support teaching and learning.

He further indicated that the sources of revenue for the fund would include:

- Donations from organisations deploying the use of science and technology;
- Contribution from strong and motivated alumni network of the College of Engineering, KNUST;
- Allocation from portions of College of Engineering Internally Generated Funds;
- Investment interest accruing from investing part of the fund with credible investment houses;

- Voluntary monthly contribution to be deducted at source from current academic and non-academic staff salaries within the CoE; and
- Private sector organisations, individuals, student associations etc.

Prof. Kponyo informed the Board members that the fund would be used to:

- Expand infrastructure and research programmes and activities;
- Provide financial support for brilliant but needy students by way of scholarships and other bursaries;
- Recruit critical academic and non-academic staff on a temporary basis until Government gives approval for their appointment to be regularised; and
- Recruit post-doctoral fellows to enhance the research output of the College.

The Deputy Project Lead also touched on the governance structure of the endowment fund and the functions of the Board of Trustees.

The Board Members advised that as a matter of urgency the database of KNUST College of Engineering Alumni should be constituted since the Alumni can be of great help especially as the College plans to establish an Endowment Fund.



Prof. Jerry John Kponyo (Deputy Project Lead, KEEP)

KNUST develops Ventilator to Support COVID-19 Care & Management



Dr. Henry Nunoo-Mensah (Member, KNUST Ventilator Project) explaining how the ventilator operates, at a press briefing

In early 2017, the Department of Computer Engineering of KNUST and the International Business Ventures Group of the Michigan Technological University (Michigan Tech) in the United States of America jointly started a project with the objective to boost health service delivery to patients with breathing deficiencies and disorders, by designing and implementing inexpensive but effective ventilators. This cooperative effort was led on the KNUST side by Professor Kwame Osei Boateng (the then Dean of the Faculty of Electrical and Computer Engineering) and Dr. Yacub Ahmed (the then Coordinator of the Biomedical Engineering programme) as the students' project supervisor.

Michigan Tech developed an earlier prototype ventilator dubbed 'IBV Ventilator' and later in 2017, a KNUST students' project succeeded in coming up with another prototype, the 'KNUST Ventilator'. The project group consisted of six

(6) final-year project students of the Department; Akwasi Darkwah Akwaboah, Josephine Owusu-Akyaw, Ayesha Tiwaa Ahmad, Isaac Kumi-Koduah, Stephen Kwabena Asante and Afua Boakyewaa Appiah.

The original prototype had configured the basic pneumatic system with an arduino-based circuitry as the embedded control subsystem. The inclusion of a single-board computer, however, was causing significant heat generation that made usage over long periods a concern. The current prototype being developed is an improvement of the original design and would address the issue of significant heat generation.

Lack of funding stalled further development till Ghana joined the rest of the world to fight the COVID-19 disease. Currently a team of lecturers has been put together under the leadership of Prof. Kwame Osei Boateng (the current Director of the KNUST

Institute of Distance Learning), to prepare the prototype for further development. As a first step the team has optimised the control circuitry by among other things, replacing the arduino board with the atmega microcontroller chip. This has reduced heating significantly.

At a press briefing held on 23rd April, 2020, Prof. Boateng said as part of enhancements to the project, the team was considering the use of external signals from the muscles of the conscious patient, as a feedback signal to trigger the ventilator into operation.

Prof. Mark Adom-Asamoah, Provost of the College of Engineering, KNUST, said that breathing was an essential human function necessary for the sustenance of life, and that unfortunately millions who grapple with breathing deficiencies were usually unable to access or afford care. This, he said, was due to the expensive nature of the few available ventilators, which were even bulky in nature.

Prof. Adom-Asamoah was hopeful that after clinical testing, the equipment would be produced on a larger scale for the benefit of the country.

Mr. Kojo Opong Nkrumah, the Minister for Information, in Ghana tweeted that, *"It's exciting to note that researchers @KNUSTGH have announced the local production of a local ventilator. In the coming days we will have to engage and get the necessary approvals to procure and use some if need be. Well done guys."*

KEEP-AGI Energy Audit Services

As part of activities to strengthen academia-industry relationship and make academic research more relevant for the development of industries, KEEP facilitated the conduct of an energy audit at Vestor Oil Mills Limited, a food processing company located in Kumasi, in the Ashanti Region.

The College of Engineering, KNUST, recognises that, to continue to make its research relevant to society, it will need to collaborate with private companies, public institutions and Government agencies to bring its services to their doorsteps. It is in light of this that, the College, through its KEEP programme has undertaken this community service of energy auditing, with the target of helping industries to optimise their electricity usage.

The energy audit, which was conducted over a three-day period, took inventory of energy supply and consumption in the company. In addition, the operation mechanisms of major equipment such as pumps, motors, boiler, lighting system, heat exchangers, cooling towers, etc, were monitored to evaluate how the rate of electricity usage of such equipment could be optimised.

The leader of the energy audit team, Dr. Richard Opoku, indicated that initial analysis of the data has revealed potential savings in electricity consumption by about 15-20%, by incorporating energy-efficient motors together with energy management techniques for other equipment in the facility. He also indicated that the company has a potential to diversify its electricity portfolio to include renewable energy options, such

as solar energy, to augment electricity demand at the company. Waste heat recovery from the oil cooling room could also be harnessed for preheating feed water to the boiler, with the potential to further optimise overall energy usage in the company.



Measuring the speed (rpm) of the motors using digital tachometer



Measuring of electrical power of the systems/equipment from the main/control room



Data logging of the energy consumption of a generator plant at Vester Oil.



KNUST to host a Sustainable Energy Centre

The Millennium Development Authority (MiDA) is to institute three new Sustainable Energy Service Centres (SESCs) in the Country, in collaboration with the Energy Commission (EC), the Energy Sector Regulator.

The establishment of the SESC, which will be the first of such Centres in Ghana, forms part of activities under the Energy Efficiency and Demand Side Management (EEDSM) Project, one of four Projects in the Ghana Power Compact Programme being funded by the United States Government, through the Millennium Challenge Corporation (MCC).

The SESC's will be hosted by three separate consortia of tertiary educational institutions, selected through a competitive process. The three (3) beneficiary consortia are:

1. University of Energy and Natural Resources (UNER), Sunyani in consortium with the Sunyani Technical University, Kumasi Technical University, and the Energy Foundation, Ghana;
2. Accra Technical University (ATU), in consortium with the Institution of Engineering and Technology and the Centre for Renewable Energy, Entrepreneurship and Innovation; and
3. Kwame Nkrumah University of Science and Technology (KNUST), Kumasi.

A study by the Consultant to the Project, Messrs. Development Environenergy Services Limited (DESL), reported that adopting energy-efficient systems will result in annual savings estimated at 4000 GWh. This represents over 30% of the country's current energy demand. It is also estimated

that a minimum peak load savings of 500 MW can be achieved with the adoption of energy efficient behaviours, thereby reducing the need for additional investment in generation capacity.

Through the SESC's, the Energy Commission aims to build capacity in energy auditing. This will ensure that a core of qualified and certified professionals is available in Ghana to assist public and private institutions, industrial and commercial customers, to adopt and implement cost-effective energy saving measures.

Additionally, the SESC's will ensure the availability of trained and qualified manpower, who will carry out market assessments and advise Government and Regulators on appropriate policies to adopt in the Sector. The SESC's will also provide technical services, such as energy auditing for consumers, and towards

project development, and project implementations, as well as provide risk assessment to Banks and Financial Institutions, in order to facilitate the development of appropriate financing instruments and products. Development Finance Institutions can also benefit from the availability of Energy Auditors with skills in the design and implementation of programmes for the transformation of the Sustainable Energy (SE) market in the country. Ultimately, this initiative will act as a catalyst to stimulate the Sustainable Energy market and generate employment in the EEDSM sub-sector.

It is expected that each of the three consortia will nominate representatives who will be trained under a specially designed “Training of Trainers (TOTs)” Programme, to

equip them with the skills needed to act as Faculty for future Training and Certification Examination Programmes. The training courses and curricula developed for the three (3) categories of energy services professionals are:

- (i) Sustainable Energy Management Professionals (SEMP);
- (ii) Sustainable Energy Audit Professionals (SEAP); and
- (iii) Energy Audit Practical Professionals (EAP).

The trained Energy Services Professionals will work under the supervision of the Energy Commission to provide tertiary level education in Sustainable Energy, including the Training and Certification of Energy Auditors.

All three consortia are to benefit from essential capacity-building exercises that will empower them to host the SESCOs and operate them sustainably. The consortia will further be equipped with the skills to prepare business plans and marketing strategies for the successful operation of the Centres.

To set off the Programme, MiDA will provide each of the SESCOs with a Starter Pack of energy auditing equipment. The SESCOs will support their operations with revenue to be earned from the training and certification services, and consultancy services in sustainable energy that will be offered to Government agencies, State Owned Enterprises, private businesses and other stakeholders.

COVID Corner

General COVID-19 safety protocols

- ** Observe social distancing;
- ** Avoid handshaking
- ** Wash your hands often with soap and water for at least 20 seconds.
- ** Cover your cough or sneeze with a tissue, dispose of the tissue in a closed bin, and then wash your hands.
- ** Always wear a mask, particularly when leaving home.
- ** Avoid touching your eyes, nose, and mouth.
- ** Clean and disinfect frequently touched objects or surfaces such as remote controls and doorknobs.
- ** Avoid close contact with people who are sick.
- ** Call the designated health line(s) in your district for necessary assistance or support if you develop fever, cough, or difficulty breathing. You can also call any of the following toll-free numbers for assistance: 112, 0509497700 & 0558439868



Confirmed cases of COVID 19 and Treatment Outcomes, Ghana as at 22 November 2020

Category	Number of cases	Recovered/ Discharged	Severe	Critical	Dead	Active
Routine Surveillance	20,697	50,009	13	4	323	775
Enhanced Contact Tracing	30,282					
International Travelers (KIA)	246	159				
TOTAL	51,225	50,127	13	4	323	775

*Critical – 3, 2 on ventilator, Severe – 8

INTERNSHIP AT KUMASI HIVE

By God'sable Sitsofe Koku Aidam (MPhil.
Renewable Energy Technologies)

As part of efforts to gain first hand exposure of real world field experience to harness the skill, knowledge and theoretical practice from the classroom as well as build network with industry, I undertook a 10-week internship programme at the Kumasi Hive.

On a familiarisation visit on the 9th of July, 2020, I was introduced to Mr. Samuel Asare, the CEO of Nastech Power Solutions. I therefore commenced my internship with Nastech Power Solutions at the Kumasi Hive on 13th July, 2020.

Kumasi Hive is a multi-space Innovation Hub which provides a platform for rapid prototyping of ideas, supporting local innovations and impact start-ups, and promoting entrepreneurship. Based in Ghana, the Hive promotes sustainable industrialisation by lowering the barriers to creating small-scale local manufacturing businesses for products needed in the immediate community. It seeks to develop a sustainable business environment in Ghana, and has produced some brands in Ghana and beyond, one of which is Nastech Power Solutions.

Nastech Power Solutions Ghana, is an electrical and electronics manufacturing company that develops and manufactures regular electrical appliances for households and Small and medium sized enterprises (SMEs) in Ghana. Nastech Power Solutions develops high quality solar power generators, solar inverters,

lithium batteries, and handles the installation of solar off-grid systems, mini-grid systems for rural electrification support, and grid-tie solar installation systems.

It is a duly registered company with an office located in the Kumasi Hive. Over the period of this internship, the activities carried out mainly involved the manufacturing of solar generators, among other services. The process includes metal sheet work such as cutting, welding and spraying to manufacture casings for the solar power generators. Electrical works were performed in building lithium ion battery packs, and fitting inverters into the solar generators. I also had the opportunity to visit the field in the delivery and installation of a solar generator for a client.

During my internship I had the opportunity to apply acquired classroom knowledge to real world situations. Some include energy audits to size electrical load consumption of clients, appreciation of the performance of solar panels with regards to the various environmental conditions, understanding of the concept of harmonics in electrical appliances induced from Renewable energy sources, and the development of business proposals. I also acquired new knowledge in the use of lithium ion batteries for solar systems, operation of inverters and sheet metal work, among others.

In all, my internship was successful. Although I was not well

versed in power systems, I was able to relate well with operations regarding electrical and electronics. I had the opportunity to acquire some new skills and practical experience which broadened my knowledge base and developed a good network with operators in the Renewable energy industry.

I appreciate the opportunity to have my internship at the Kumasi Hive, under the supervision of Mr. Samuel Asare, the CEO of NASTECH POWER SOLUTIONS who was very instrumental in making my internship a success.

My internship finally came to an end on 25th September, 2020.



Building a 24V Lithium ion battery pack for a 5000W solar generator

KEEP HANGS OUT WITH ING. WILLIAM AMUNA

(TECHNICAL CONTROLLER, MILLENNIUM DEVELOPMENT
AUTHORITY (MiDA) AND FORMER C.E.O OF GHANA GRID
COMPANY LIMITED (GRIDCO))



Ing. William Amuna

KEEP: WHO IS ING. WILLIAM AMUNA

ING: Ing William Amuna is an Electrical Engineer with about 35 years' experience in the industry. Ing Amuna attended the Navrongo Secondary School, then continued to the Ghana Secondary Technical School (GSTS) in Takoradi and then entered KNUST, graduating in 1985. Thereafter, I did my national service with the Volta

River Authority (VRA) from 1985 to 1987; at the time, national service was for 2 years. On the same day I was done with national service I was employed by the Volta River Authority as an Assistant Engineer. I worked with the VRA and rose to the rank of 'Director for Technical Services'. Thereafter I continued to Ghana Grid Company Limited (GRIDCO), where I became the Chief Executive of GRIDCO from 2013 to 2017. Now, after my

engineering training, I also undertook some training: an MBA in Finance and then an MPA in Public Policy, and I think that also has helped me in the work I have been doing.

KEEP: WHAT VALUES HELPED YOU CLIMB THE CORPORATE LADDER?

ING: One is hard work, and then continuous learning. Hard work: I needed to put in a lot in whatever I was doing, I needed to go the extra mile in whatever I was doing in order to achieve the goals of the institution. I think that helped a lot. One other guiding principle is discipline. I was very disciplined, I made sure that I was never late to work, I was always very prompt. Anytime you got to the office (we started work at 8:00am, but normally by 6:30am), you would find me at work, and I have done that up till today. I mean even now; I still go to work very early. I leave early to work and make sure I'm there before the start of work. That level of discipline is very important. If you seek to become a leader, you must first be a servant. That is the best way. You just need to make sure that you do the ordinary things very well, you go through all the rules and everything. Obey the rules and then when you get to the top, you can enforce those rules. Otherwise, you are going to run into trouble.

I met the Managing Director of a Ghanaian company (a former managing director), and he told me that, with their company, they always found out those who were potential leaders in the company and what they did was that anytime they recruited management trainees, they would give them a vehicle, give them fuel, and then after a month, they get to know those who are potential leaders. They study how they maintain the cars, how much fuel they consume as well as high mile-ages. If you want to be a leader in a company, you should know how to manage the assets of the company.

KEEP: WHY THE DECISION TO STUDY ENGINEERING?

ING: Very interesting question. My father was a military man, I was born in Burma Camp, and it's normal that the children of military men would want to become soldiers, so that was my desire; to become a soldier. Now, when I told my father, he told me that I wasn't a gentleman so he wouldn't allow me to go to the military because military men are supposed to be very gentle and he thought I was way too active and he didn't want me to get into trouble in future so he thinks that I should leave the military out. I told you earlier on that I attended Navrongo Secondary School. At the time I was there, the headmaster was a Scottish man: Collin George Macdonald, and he was a scientist, he could build anything. I mean he was virtually working every time and many students worked along with him, so in working along with him, I picked up that idea that I could become an Engineer. Then also, some of my seniors, when I was in the secondary school became engineers, and I thought that, that was a very good field to go into,

so ultimately, that was where I was supposed to end, and I did. And I think that I have not regretted that.

KEEP: ARE WE DOING ENOUGH IN RELATION TO POSTGRADUATE STUDIES IN ENGINEERING?

ING: I don't think we're doing enough, and I wouldn't blame the universities. I think that the major problem has been with funding for the universities. I'm really very sorry for the universities, especially at this particular time of the pandemic; I know what the universities are going through, so for me, I think we are not doing enough, and it is mainly due to funding.

KEEP: WHAT MORE COULD BE DONE IF THERE WAS ADEQUATE FUNDING?

ING: What you could do is that you could have modern laboratories, you could have, you know, very good research centres, you could have many more lecturers, you could have many more branches, you know, many more subjects that are being taught at the postgraduate level. I mean there are students who may like to undertake a particular course that may not be done here in Ghana, but with funding you're able to expand more and then do many more things.

Apart from that, you look at the students; the moment they graduate, their parents expect that they should be working and bring monies back home. Now, imagine that you graduate, your parents think that now they're settled; at least they spent enough money on you, and then you go back to tell your parents that you're going for further studies; you're taking more money from them?

We need scholarships for the students. We need to find a way that any student who is there, has that necessary support to be able to undertake the post-graduate training. That was why I was very proud when I heard of the KEEP programme by KNUST. Incidentally I'm an Industrial Advisory board member and I'm so happy to be one, because I think it's a very good thing that has been done and it should be encouraged.

KEEP: IS THE KNUST ENGINEERING EDUCATION PROGRAMME ON COURSE AND WELL STRATEGISED?

ING: Definitely, I have seen what KEEP is about and I think we're on a very positive path. Definitely we're going to have very good laboratories and then research areas. We are going to support the students that will be coming in, so that their parents will not have that worry of continuously spending on their children when they're of age, and then I guess we are going to have many more lecturers; very good lecturers that would come in there to support the students. I believe that if that happens, in a matter of five years or so, we should be okay. We would also need to collaborate with other universities in order to keep such programmes going. I mean it shouldn't just be KNUST; I know that KNUST is already collaborating, I remember there was this programme with Texas A&M or so, I mean we should encourage such programmes as well.

KEEP: IN YOUR OPINION, WHAT MORE COULD BE DONE TO PROMOTE POSTGRADUATE TRAINING?

ING: What we need more is to get the very bright students interested in the postgraduate training. It's also very important.

Sometimes when the students go out and then they get very good jobs, they virtually forget about postgraduate training. So there should be that system that would encourage them to come back for the postgraduate training; it's important.

Then we would also need to make sure that the training has a strong practical bit, such that when the students come in, they know that the moment they're done, they would get a job somewhere to do or they could start their own job.

KEEP: IS THE ASSERTION OF NON-SATISFACTORY PERFORMANCE OF ENGINEERING GRADUATES IN INDUSTRY A VALID ONE?

ING: I don't really, fully agree with that. You know, when you graduate, to become a very good engineer. There are three people who can make you the good engineer. One is the university, by giving you the proper training, the second one is yourself; you must really work hard and build your capacity to be able to work, and the third is industry; wherever you find yourself, they should also bring you up.

Now it is not possible that you just get an engineer from the university, he gets to industry and then starts working the first day; that is not possible. It is only possible when you have very good internship programmes.

In some countries, what they do is that during their years in the university, they (students) go out to certain industries, for internship. During that period, they're able to build (themselves) up, so when they get into industry, it becomes seamless, you know. But unfortunately, we don't have that here for the students who normally go for internships, nothing

much is done. I have received so many such students.

What should be done is that industry should get very concrete programmes for them but because the numbers are so many, just because a few industries want to actually absorb them, you know. When I was in GRIDCO, we could take up to about 150 students, just because many industries wouldn't take them, so when you take such numbers, you're not able to actually bring them up. So the students would have to also do their bit in learning, but when they come to industry, it is the duty of industry to train them.

When I entered VRA in 1985 during my national service period, for two years, I was at the VRA training school, undertaking what we call protection and control training. You go in there for training, they send you out to the field, then you come back, you know, continuously. So at the end of two years, I became a Protection and Control Engineer, and I'm happy to say that all the sub-stations that were built in the north (of Ghana), from Techiman to Sunyani to Wenchi, I was the Commissioning Engineer. I was a very young Engineer at the time. So just two years after school, I became a Commissioning Engineer; I commissioned every sub-station there. I had to declare that the sub-station was okay before we could knock on, so I would do all the testing for major bulk supply points, all round the country.

So it is important that the university brings the students up; it's important that we have very good internship programmes and that should stem from the industry. I mean, they should help in getting these internship programmes going through.

It is also important that the student builds their own capacity, apart from the classroom work, you should also be learning; we have resources like YouTube® and other platforms. They're very good resources that you could learn from, you know. Then finally, it is the industry's duty to train the students who will come (to them). If you expect that, look, I have employed you; you're coming to work; no, that's not right. And there are many institutions around that have training facilities that would always bring the students up.

VRA has a very good system. There's the VRA learning academy, as they call it now, where they train the workers there, as well as the new entrants of VRA. Now there are many industries around that don't have such facilities because it's costly, I mean, it's not that easy to run such training institutions. So what such industries do is that sometimes they go round poaching, and then they get the trainees; they give them better offers and then the trainees would go to those industries to work for them.

KEEP: HOW CAN THE ACADEMIA-INDUSTRY LINKAGE BE ENHANCED?

ING: I don't think we're doing enough with regards to academia-industry linkages. I don't think so. It is also important to note that most products from industry normally emanate from the academic institutions. Through their research and the rest of it, they come out with products that industry would quickly pick up; maybe they pay for it and then utilise. So it is important that you have academia and industry working together.

The problem here is that we are not doing enough; we don't

have any support for the universities from industry, and that's a big challenge. Now, how are we going to solve that? We are going to solve this problem of lack of linkages, if I may say so, between industry and academia by coming out with policies that would encourage this kind of arrangement, and it's not for free, of course. Sometimes, if you give that support to academia, there is something in return. I mean some countries do that.

Okay, now the next thing is that for industry to be helping academia, then they (industry) should be seeing something. I mean something that they could gain from that relationship, okay? If they don't see that, it becomes a big problem.

Now, I'm not saying that industry should come and tell the universities what they should teach their students, but there should be this avenue that would allow industry to have some input in the kind of training given to the students for certain industries. It is very important that, for certain industries, you'd have the universities listening to industry, and then coming up with programmes that would help them, you know, undertake their jobs effectively. That is very key, if you want the two of them to work together.

Then the other way round is also true; if an industry, needs help for certain problems they encounter, they would have to go to academia. You (industry) needs to support them (academia); if you don't support them, and they're not able to pay their lecturers properly, the lecturers may leave academia and go into industry. That would be a big problem. Who's going to train the students? Who is going to train the engineers? So it's important that

industry also, pays back in a way that would encourage academia to also help them.

KEEP: IN WHAT WAYS CAN ALUMNI BE PROMPTED TO OFFER SUPPORT TO THEIR ALMA MATER?

ING: Well, sometimes it's voluntary. We don't need to force anybody. There are people who are out there that you could always bring to some of the functions in KNUST, and then during the function, some of the problems or the challenges of the University are made known to them. Some of such people will go and then come back and help; it's important.

We also need to keep the database of alumni. Occasionally, if there's a major challenge, you can send messages out to alumni telling them that, look, we want to set up this particular laboratory, it's going to cost this much, and we need support from alumni, or whoever wants to help to do that, and I think that would work. So having a very good database of alumni is very important.

KEEP: WHAT IS THE FUTURE OF GHANA'S ENERGY SECTOR?

ING: Very bright. You know, the oil and gas find during the last ten years, has been very positive. Now we have our own oil, we have our own gas. There used to be a time that geo-political tensions somewhere would cause oil prices to spike; a barrel could go to about \$140 and then it sends everything in the negative direction in Ghana but at least now we have gas, we have oil, and then continuously we're finding more and I think that's very good. KNUST, I know you're training students that will actually run some of such industries. We

should intensify that and then get our own people running such facilities; so it's a big opportunity for our students.

With the electricity sub sector, now we have excess power. We have excess power. I mean at the time I was CEO, somewhere 2013, 2014, there was massive "dumsor" (Dumsor is a Ghanaian term coined to mean frequent power interruptions). But as we stand now, if our neighbours want about 1000 megawatts of power we can give it to them. We have more than enough. What is left is that we need to look at technology and make better use of electricity. This is where KNUST would come in. KNUST would have to undertake research into energy efficiency and demand side management. It's very important, you know, look at efficient uses of energy.

Presently I'm working with MiDA, and we are organizing what we call Energy Services Centres, and the good news is that KNUST is one of the institutions that was chosen. They have gone through all the training, they're going to train people to undertake energy audits and the rest of it. So that if they do that and then they find certain industries inefficient, they should be able to get back to KNUST to get them to undertake studies or research that would make such industries very efficient.

Now we have this other thing that has come up: Micro Grids. Micro grids have become the latest technology and it's actually being done everywhere, its trending everywhere and we need to get KNUST very involved in micro grids. With micro grids, we're able to get some island communities, etc., having electricity. There are certain communities in Ghana

that, there's no way you can send the grid to. You could go in there create a micro grid that would be utilised. You could also even within areas that you would have electricity, create micro grids and I think KNUST should be very interested in that. It's a very important thing.

So the opportunities are there. Now the energy sector is open and we should seize that opportunity. Get our students involved, get the lecturers involved, get all the researchers involved and then, it should be good.

KEEP: HOW DO WE TAKE ADVANTAGE OF THE OPPORTUNITIES THAT THE ENERGY SECTOR PRESENTS

ING: It is important that people get to know what you can do; very important. One way of doing that is having what we call the *road show*. You could go out, look at certain industries; things that you have done within KNUST, go out and then talk to the people [saying], 'We have been able to do this and that and that, can we collaborate to make it better?' So there should be that knowledge sent to all the people that you may be dealing with or that, you know your research would be covering. It is important that people get to know, what you're capable of doing. If they don't know, everybody will sit aloof and then nothing happens at all.

When I was in GRIDCO, virtually all the engineers were from KNUST. Majority, I mean majority of the engineers were from KNUST. So what is the tie between GRIDCO and KNUST? So we need to build that up. I remember we [GRIDCO, ECG and VRA] sponsored, a laboratory or so. That should continue.

We have very bright students. I mean this thing that people say the young ones who are coming don't know anything... no [it's neither here nor there].

I was in Japan for a meeting and I was on my phone, so the Japanese sitting next to me saw what I was looking at and then he asked me, "What is this?" And I said well, "I'm looking at the Ghana power system live", and he said "Oh where did u get the software?" and I said, "Oh it was designed by one of my engineers." He said "Wow!" and he took the thing [phone], went through everything and he was amazed. That young man was from KNUST.

KEEP: MESSAGE FOR UPCOMING ENGINEERS AND ALUMNI

ING: Upcoming engineers, they must work hard. They must really work hard. They must throw the 'box' away; people say think outside the box, no, there shouldn't be a box at all. They should really try to expand their knowledge, and there are so many resources now, on the internet and everything that they could, utilise to expand that knowledge.

Now, one thing too I would also add is that, they shouldn't only concentrate on the field where they studied. They shouldn't. I worked somewhere with a mechanical engineer and the guy was so knowledgeable in electrical engineering. I was surprised, I thought he was an electrical engineer. When he told me he was a mechanical engineer, I was very surprised. So apart from what you've learnt, learn everything, from.... as they normally say from archaeology to zoology. Whatever, subject that you think that you should be able to learn, go ahead and then learn it.

It is important that the first few years, they don't come around joining political parties, no. They should study their subjects, study other subjects that are linked to their courses, and maybe, that can make things better for them and then after some time, if they want to get into politics or anything else, they can do that. But the moment you're an engineer, you come out and then you don't get into your field, after a few years you become rusty and you find it very difficult getting back there. Nobody would employ you anyway, so it's important.

Now with the alumni, I know they've been doing a great job. I have met with them several times here, right in this room; I mean they used to visit me. We had discussions; I was appointed an ambassador for the alumni, and we've been doing quite a good job, going round, fund raising. There was a time that we went round raising funds and I think it was very good so, they should be encouraged. They're doing a very good job. I remember there was some time they brought a number of students to Akosombo, hosted them, they took them through some training, and actually visited me in Akosombo and that was very good.

KEEP: ANY MESSAGE TO VIEWERS AND STAKEHOLDERS?

ING: Thank you very much. I would also like to thank KNUST for the training they've given me, and like I told you earlier on, I have three sons and they're all electrical engineers. They were all trained by KNUST, so for my family personally I mean I think that, that has been very good so thank you KNUST, good job.

Thank you!

The **KEEP** Story as told by PROF. NYARKO (PROJECT LEAD, KEEP)



Prof. Nyarko

Q: Hello Prof. Thank you very much for making time to share the KEEP story.

Prof. Nyarko: My pleasure.

Q: Please tell us a little bit about yourself.

Prof. Nyarko: Thank you very much. My name is Kwabena Biritwum Nyarko. I'm an Associate Professor in Civil Engineering. And I work in the area of Water Supply and Sanitation. I am also the Project Lead for KEEP, which stands for KNUST Engineering Education Project. KEEP is one of the Africa Centres of Excellence (ACE) funded by the Government of Ghana through the World Bank.

I am also the Vice Dean for the Faculty of Civil and Geo Engineering. In the past I've worked on various projects such as the WASH Cost Project (The aim of the project was to quantify the cost of providing sustainable water, sanitation and hygiene services in Ghana, Burkina Faso Mozambique and India), from 2008 to 2012. The project was a \$15 million Project. In Ghana we spent a direct budget of around \$1.5 million, and I managed the Project. I'm also working on a few projects funded by UNICEF.

Q: Could you please tell us more about KEEP?

Prof. Nyarko: The background to the KNUST Engineering Education Project (KEEP) is that the World Bank designed a project, called the Centres of Excellence Project, in the form of a loan facility to the Government of Ghana, to the tune of about \$60 million, to support postgraduate education. The World Bank thus called for the submission of Proposals to establish Centres of Excellence, indicating that any College of Engineering that would win two or more bids would be given 'add-on' money, to be used in enhancing postgraduate education in Engineering. KNUST successfully won two of the project bids: one project focused on

water, and the second on transport. Because of that we were eligible for the add-on project, which we decided to name, KEEP. The main objective of the KEEP project is to expand access to, and enhance education and research at the postgraduate level, since KNUST already trains lots of undergraduate students.

Postgraduate education in engineering is very critical because if we're able to train highly skilled manpower, and do it well, it will transform and drive the economy in the right direction. As a country we have initiatives such as the 1 District 1 Factory, talking of industrialisation, talking of the fourth Industrial Revolution, and we need highly skilled manpower, to do these. Currently, it seems the Ghanaian economy heavily relies on expatriates because we do not have adequate highly skilled manpower.

So in order to enhance the quality of education, we have activities such as international accreditation, which will confirm, that we're delivering good quality education here.

KEEP believes a strong partnership with industry is critical because the university should have strong impact on industry. It should make Ghanaian industries more competitive.

And what we'd want to see is that KNUST as a technological University will have a lot of start-ups; we should have technology giants in Kumasi because of the presence of KNUST. This is what we want to see.

Q: How does KEEP hope to achieve its target of increasing the number of students in postgraduate education, and providing quality education as well?

Prof. Nyarko: In fact, we are targeting the two. We have a target of admitting 100 MSc and 75 PhD students. And I must say looking at the historical records on postgraduate admissions, among others, we will definitely exceed that. In the first cohort (2019/2020 academic year) we recruited 118 (81 MSc and 37 PhD) postgraduate students, and in this cohort (2020/2021 academic year) that we are admitting, hopefully, we should get more than that. Some of the activities to help us achieve this target is that in terms of admissions, most of the students want to go outside for postgraduate education; and there are opportunities for that to happen, especially when there are scholarships available. So when the students graduate and get scholarships to study in Korea, America, UK, etc, they would opt to go. We don't have a lot of scholarships in Ghana and that makes it difficult to attract brilliant students at the postgraduate level. So that is one of the challenges we are seeking to address.

What we are doing at the moment is that we're using funds from the project to give out scholarships. But there's a limit to what we can do.

The second activity is we're reaching out to industry, to see how they can support, because we believe it will be a win-win situation.

Even before the start of the KEEP project, Tullow Ghana Limited supported the College financially, which helped to support a lot of undergraduate and some postgraduate students. GNPC has also supported the Petroleum Engineering Department with \$1m for four years, so some students benefit. We reached out to

Vodafone and they have pledged support for female students reading engineering.

In terms of the quality of education we offer, we want to enhance this further via the learning environment so we want to put up a building, which we wish could be much bigger and with more space and more equipment than our current financial capacity allows us. But we are confident that with the necessary support from stakeholders, we'll bring more to the table so that we can continue giving the best form of education to our postgraduate students, who will in turn give back to industry.

We want to work more with industry. What that means is we engage industry even in defining our research areas to ensure that the research is relevant to the needs of industry.

Let me also mention that we're about to conduct a GAP Assessment, with the main objective of interacting with the employers, industry, to find out their needs, interact with our recent graduates, interact with the graduates who've been in the system for long, to get feedback. So based on their feedback and the recommendations, we may revise our curriculum because we want the Programme to respond to the needs of industry. And if we're training them for industry it should be what industry wants.

Q: Please tell us what is meant by KEEP being 'results-based', and then also about the Disbursement Linked Indicators

Prof. Nyarko: The KEEP project is essentially designed to be results-based, with a budget of \$5.5 million, but if you don't deliver you don't get the money: you

have to achieve results before you get the earmarked money. And the expected results are linked to certain indicators or activities to be undertaken towards enhancing postgraduate education in Engineering. So when an activity is completed, the funds earmarked for that particular activity is then released. So essentially, the University pre-finances these activities, only to get a refund if and only if, the activities indicated are completed on time.

So for instance the Project started in January 2019. But the first bit of funding was released in May 2020, after we had completed the required activities. And if we are not interested in any of the activities indicated, then we don't get the funds released.

For example, if we decide we are not interested in international accreditation, recruiting PhD students, or if we don't prepare for procurement documents on time, or follow the procurement guidelines, then the monies allocated for these will not be released to us.

So that is how the Project has been structured and the Indicators are linked to the results, and then you can apply for the money, after the results have been verified.

There are times that the verification process can be a bit time consuming. For example, because the Project seeks to enhance postgraduate education, we encourage more students to enrol on the programme. But the funds available is only \$5.5 million. But if we were to give scholarships to all students who apply, we would need at least \$10 million due to the numbers. So we are only able to give limited scholarships. So to ensure the

sustainability of the Project, we have to look for money and get some students to pay. This has not often gone down well with some students who are unable to get the scholarship, and they refuse to have anything to do with KEEP. And so during the verification, they tend to disassociate themselves with KEEP, and that is very unfortunate and unfair. And we explain to them that the Project is to improve the quality of education, as well as enhance enrolment. Not everybody can get a scholarship. But when we get International accreditation, the quality goes up, everybody benefits. When we arrange for internships for students, which is one of the activities required to enhance the quality and employability, it helps the students to have an idea of how work in the industry looks like, they get to develop networks, and also practice what they learn in the classroom, and gives them the needed exposure.

Q: What would you want to see after five years of KEEP?

Prof. Nyarko: Interesting question. After five years we should be able to point to some industries that have become more competitive because of KEEP. We should have more startup companies, and we should see that some industries have grown more vibrant, all because of KEEP.

Let's not forget that five years may not be enough. So beyond five years, we need to do more. Typically, a student who undertakes PhD education outside Ghana averagely needs about \$50,000 to be able to complete their education, and this means that student would be contributing more to the economy than the \$50,000. So what KEEP seeks to do is to try to provide an enabling

environment that will retain majority, if not all of such smart and brilliant students to pursue their postgraduate education here in Ghana, so in the end they can contribute to the economy.

To be honest, all vibrant companies the world over are doing well because of research. With regards to the 1 District 1 Factory for example– if we want them to be competitive, we should assign students there. As a country, we're not investing much into research, and so we're not getting the results. I wish we could invest more in research and also target it.

One of the things we're doing is that we have formed research groups, who have been charged to prioritise research that will produce tangible results through the postgraduate programmes, after the five years. So for instance if there's a challenge that needs addressing in industry, and say that would require 5 PhDs, and 8 MSc research modules, we simply put that number of students to task to conduct the needed research and produce tangible results within the period.

So the dream is that we should have clear problems, assess them and come up with clear solutions. But we still have some way to go.

The challenge here is that for a long time we've not had adequate funding for research, especially on this KEEP project. The budget only allows for limited stipends and tuition fee coverage, and so we're also unable buy equipment. The stipends for the students are not enough, and we're unable to provide full scholarships for most of our students. We would have doubled the amounts if we had more funding. So that is something that needs addressing.

We also want work hard within the five years, to get industry to believe in what we do. In that case they could come on board with funds to sponsor the programmes that we run. And in return, the research students could be tasked to provide research results that would enhance their businesses. This would go a long way to build local capacity instead of constantly bringing in expatriates to provide solutions, which we already have.

Q: So specifically, what kind of support does KEEP need to be able to go the extra mile?

Prof. Nyarko: Within this period, we need to foster stronger partnership with industry. We need industry to sponsor postgraduate students, where we can work with industry to address challenges and issues that are of interest to them, then that would be a plus.

Q: What are the plans for sustaining KEEP beyond the funding period?

Prof. Nyarko: The most critical element of sustaining KEEP beyond the five-year period is finance, especially with regards to making scholarships available. KEEP is also putting up a building with lecture rooms, research laboratories and equipment to enhance the quality of postgraduate education.

Beyond the Project, there could be no money for scholarships. This would in the long run bring down the postgraduate enrolment levels. So within the Project period, the plan is to establish a strong partnership with industry, so that industry would support by sponsoring students' education.

The other is a concept note drafted to establish an endowment fund, that leverages on the alumni's contributions, and use the proceeds to set up a fund that will support postgraduate education and research.

Q: What is the vision of success for KEEP?

Prof. Nyarko: By the end of the Project, we want to see tangible impacts made on industry, we want to see more startups with our students setting up their own companies, or other related activities, and industry will be coming to KEEP and the College for postgraduate students to be attached to them, and for solutions to their research problems. We also envisage a stronger industry-academia partnership, and we want to see industry adopting some of the labs, among others.

Q: What do you look out for in prospective 'KEEPers'?

Prof. Nyarko: Your performance at the undergraduate level, and

two, your research interest. We also have the obligation to attract international students, as one of the required indicators. So at the moment we have students coming from other African countries, and we seek to attract more of such students.

Q: Any message for KEEPers?

Prof. Nyarko: KEEPers are ambassadors. They should do the best they can in their studies. Even before they graduate, we would encourage them to have ideas for their start-up companies. You know we have the KNUST Incubator Hub, we have our Innovation Centre, and we take innovation seriously because it is very important. And we're actually launching a challenge for students to submit their ideas and we plan to support the top performing ones.

So this is the story of KEEP, and all stakeholders in industry and academia, alumni, agencies who have the interest of promoting postgraduate education in engineering are welcome to come on board with their expertise, and funding, towards a more sustainable and mutually benefitting system of education.

Thank you.

KEEP Info

Location: KEEP in Room 304 on the 3rd floor of the Petroleum Building at the College of Engineering.

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