Department of Chemical Engineering celebrates its 50th anniversary

by Prof Philip de Vaal

The University of Pretoria has the biggest school of engineering in the country and offers tuition in the widest range of engineering disciplines. In 2010, the Department of Chemical Engineering celebrates its 50th anniversary. Its establishment and growth reflects the changing role of chemical engineering in society as a whole.

Wherever industrial processes are required to convert raw materials into products with a higher monetary value through physical, chemical thermal, biochemical and mechanical changes, the importance of chemical engineering to the country's economy becomes evident. The role of chemical engineering is vast, and its impact can be felt in a variety of process industries, ranging from the oil, coal, fuel, paper, food and textile industries to mineral processing, water and effluent treatment, air pollution control, polymer production and processing, the nuclear fuels industry and power generation.

The department's main focus is to use effective education and relevant research to produce graduates who will use their ability to think independently and generate new knowledge to the benefit of the broader South African society. Since the establishment of a fully fledged Department of Chemical Engineering in 1960, the University of Pretoria has been delivering chemical engineers who can be involved in any stage of a process engineering project, from the generation of an idea to the sale of the final product. This includes aspects such as fundamental and applied research, techno-economic evaluations, and plant design and optimisation.

With the increasing awareness of the need to protect the environment against pollution and the development of biotechnology on an industrial scale and in medical applications of engineering, the role of the chemical engineer is increasing in global importance. The department's research focus areas have subsequently developed to meet national and international needs. These include process modelling and control, applied materials, environmental engineering, water utilisation, reaction engineering, biochemical engineering and sustainable process systems engineering.

The Department of Chemical Engineering will also play an increasingly important role in the future to ensure the sustainable utilisation of South Africa's valuable non-renewable natural resources, which include scarce metals like platinum, chromium, vanadium and gold, as well as the country's large coal reserves. It is important to treat coal as a valuable resource for the production of chemicals, rather than as a cheap source of energy. Alternative sources of energy therefore need to be found, and this will of necessity include renewable resources and nuclear power.

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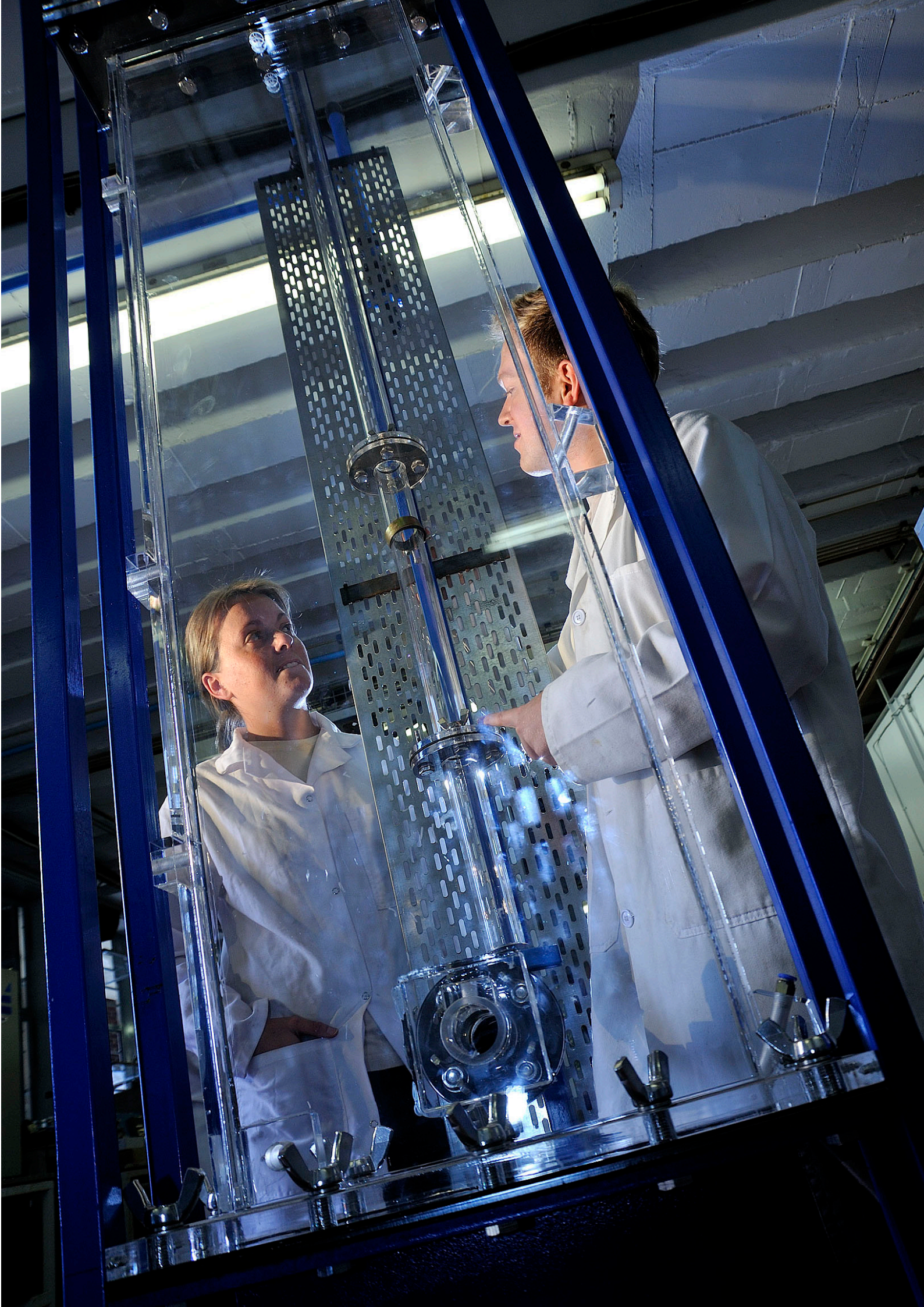
Historical perspective

Although the establishment of a faculty of engineering at the University of Pretoria was approved in 1954, it was only in 1960 that the founding three departments in the faculty (civil, mechanical and electrical

→ *The Department of Chemical Engineering will play an increasingly important role in ensuring the sustainable utilisation of South Africa's valuable resources.*



→ *The annual number of graduates increases steadily.*

engineering) were expanded to include a fourth department to cater for the students in chemical engineering that had enrolled in 1959. Prof Dawie Schoeman was appointed as the first head of department in 1960 and the first graduates completed their studies in 1962. When Prof Schoeman became dean of the faculty in 1980, Prof Uys Grimsehl took over as head of department. He was succeeded by Prof Philip de Vaal in 2004.

The first-year enrolment for the first 15 years of the department's existence was fairly stable at between 20 and 30 students per annum. By the early 1990s, this had increased to about 70 students per annum. By 2009, about 140 prospective chemical engineers were choosing to enrol at the University of Pretoria. The annual number of graduates has shown a steady increase from seven in 1962 to between 40 and 50 in the period 2002–2008.

About 70 to 80 students are expected to graduate between 2010 and 2012. The growth in postgraduate student numbers is equally encouraging: from 30 in 1985 to 65 in 1992 and 154 in 2009. The increase in the number of students enrolled for master's and doctoral degrees bodes well for the University's plan to develop into one of the country's top research universities.

There is an increasing demand for engineers (including chemical engineers) in South Africa, and the School of Engineering intends doubling the number of engineering graduates over the next ten years. To accommodate this growth, support has been obtained from government and the University Council to significantly expand the University's engineering facilities through the construction of additional lecture halls, as well as teaching and research laboratories.

Research achievements

High-quality research outputs can only be achieved with high-quality human resources, supported by adequate, state-of-the-art equipment and laboratories. To this end, the Department of Chemical Engineering has been highly successful in attracting funds to complement internal resources. Since 1960, a total of four endowed chairs have been adding value to the activities of the department:

- The Rand Water Chair in Water Utilisation Engineering
- The East Rand Water Care Company (ERWAT) Chair in Waste Water Management
- The Department of Science and Technology (DST) Chair in Carbon Technology and Materials
- The DST Chair in Fluoromaterial Science and Process Integration

→ *Third-year students regularly gain practical experience in the laboratories of the Department of Chemical Engineering.*

Several members of the department have been honoured for their outstanding research achievements. Earlier in 2010, Prof Walter Focke, Director of the Institute of Applied Materials, received the Technology and Human Resources for Industry Programme (THRIP) Award in the category Competitiveness of Industry Partner. This was for work done on the characterisation of carbon materials for use in a pebble-bed nuclear reactor. He received an allocation of $100 000 from the Bill and Melinda Gates Foundation for the development of an indoor spray to control malaria transmission. He has also developed a method to impregnate mosquito nets with insecticide where the rate of release conforms to the stringent requirements of the World Health Organization (WHO). Prof Thokozani Majozi was appointed as a research fellow of the CSIR in 2009. In 2008, he received the Silver Medal of the British Association, awarded by the Southern African Society for the Advancement of Science (S_2A_3). He is also the 2010 recipient of the South African Institution of Chemical Engineers (SAIChE) Bill Neal-May Gold Medal Award for Outstanding Achievement and International Recognition.

In 2008, the University of Pretoria honoured the 100 leading minds of the past century. Three of these scientists come from the Department of Chemical Engineering. They are Prof Walter Focke, Prof Thokozani Majozi and Dr Henk Viljoen.
The faculty also boasts several researchers with ratings from the National Research Foundation (NRF), including one of only two researchers in the School of Engineering with an A-rating. This prestigious honour goes to Prof Brian Rand, who is the incumbent of the DST Chair in Carbon Technology and Materials in the Institute of Applied Materials.

Student achievements

Students of the department are regularly recognised for their contributions at a national and an international level.

- **Edrich Malan** received the national Sasol Chemical Industries (Sastech) prize for the best vacation training report in 2006 with a project entitled *Energy balance and mineral dissolution kinetics for copper bioleaching systems*.
- **Tobi Louw** received the first prize in the Chemical Innovation Award of SAIChE in 2007 with a project entitled *Rheological behaviour of synovial fluid: effects on joint lubrication*, while **Jacqueline Barnard** came second with her project *Stabilisation of nano-emulsions against Ostwald ripening by adding Inutec SP1 polymeric surfactant*.

- **Devon Clack** was the runner-up in the Honeywell Users Group International UniSim Student Competition in 2008 for the development of a dynamic simulation of a Lurgi-gasifier and improving the accuracy of data accumulated from the Sasol gasifiers. As part of his prize, he had the opportunity to present his work at the annual Honeywell Users Group Conference for Europe, the Middle East and Africa (EMEA) in Berlin, where his project was one of the top five projects internationally.
- **Ria Muller** won the Sastech Prize in 2008 for the best vacation training report, with a report entitled *A study of the catalytic minimisation of the yield of perfluoro-isobutylene*.
- **Kersch Naidoo**, a postgraduate student, won the SAIChE Award in 2009 for the best postgraduate report with a dissertation entitled *Preparation for novel microporous polymeric hemi-shells*.
- Three students in the Department of Chemical Engineering were recognised in different categories of the 2009 Chemical Technology Award. **Ria Muller** won the CSIR Undergraduate Student of the Year Award, **Vutshilo Madzivhandhila** won the Anglo Research Postgraduate Research Paper of the Year Award and **Puxley Mashele** won the Special Environmental Award.

Prof Philip de Vaal, Head of the Department of Chemical Engineering.

Prominent alumni

Alumni of the Department of Chemical Engineering have a proud record of local and international performance:

- **Marius Kloppers**, who graduated from the department in 1986, was appointed chief executive of BHP Billiton in 2006.
- **Ralph Havenstein**, who obtained the BEng(Chem) and MEng(Chem) degrees in 1977 and 1979 respectively, was the executive director of Sasol from 1998 to 2003 and chief executive officer of Anglo Platinum from 2003 to 2007.
- **Dr Henk Viljoen**, who obtained the BEng(Chem) and MEng(Chem) degrees in 1979 and 1981 respectively, is currently professor at the University of Nebraska-Lincoln in the USA.
- **Hans van Leeuwen**, who graduated from the department in 1972, is a professor in the Department of Civil, Construction and Environmental Engineering at Iowa State University and was recently named as one of the top 100 innovators by the American National Science Foundation. He was also named as the *R&D Magazine*'s innovator of the year in 2009 for his research on the use of fungi for the production of biofuels.

The Department of Chemical Engineering at the University of Pretoria has certainly come a long way over the past fifty years to become one of the country's leading providers of chemical engineering skills and innovative, cutting-edge research in its various focus areas. It is with anticipation that it looks forward to playing an even greater role in promoting the economic prosperity of the country and improving the lives of communities, not only in South Africa, but in Africa as a whole.