‘TRAINING THE NEXT GENERATION OF PIPELINE ENGINEERS: DISTANCE LEARNING AND ACCREDITATION’

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Training the Next Generation of Pipeline Engineers: Distance Learning and Accreditation

by

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ABSTRACT

There is an ageing workforce in the oil and gas industry and the pipeline business, and there is an urgent need to both recruit new staff, and rapidly train existing staff. Consequently, the education and training of pipeline engineering staff is of strategic importance to all companies operating in the business.

This paper explains the shortage of pipeline engineers, and covers the current education and training of pipeline engineers, and briefly summarises the current courses offered by universities on pipeline engineering. It concludes that there is labour and skills crisis in the oil and gas sector, and there are very limited formal education and training courses for pipeline engineers.

The paper then covers a strategic approach to learning and education, and presents a model of structured, modular learning, using a distance learning platform. It links current industry training courses to academic qualifications. Its emphasis is on distance learning packages, and it ends by presenting a new distance learning course for pipeline engineers that has been launched by Northumbria University, UK, where pipeline engineers can obtain a Certificate in Pipeline Integrity Management, which is accredited by the university.

The paper emphasises the role of structured, modular learning packages, via distance learning, for both university courses and continuous professional development.

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1. INTRODUCTION

1.1 The Oil and Gas Business… Boom

The oil and gas business is big, and is becoming bigger, as oil prices soar, Figure 1, and demand for energy increases. Consider these facts from the US Energy Information Administration [1][1]:

- world energy demand will grow by 55% between 2005 and 2030;
- fossil fuels will remain the primary sources of energy, accounting for 84% of the overall increase in demand from 2005 to 2030; ○ global oil demand will rise from 83 million barrels of oil per day (mb/d) in 2004 to 118 mb/d in 2030; ○ global demand for natural gas will rise from 100 trillion cubic feet (tcf) in 2004 to 163 tcf in 2030; ○ coal consumption will increase from 114.4 quadrillion Btu in 2004 to 199.0 quadrillion Btu in 2030.

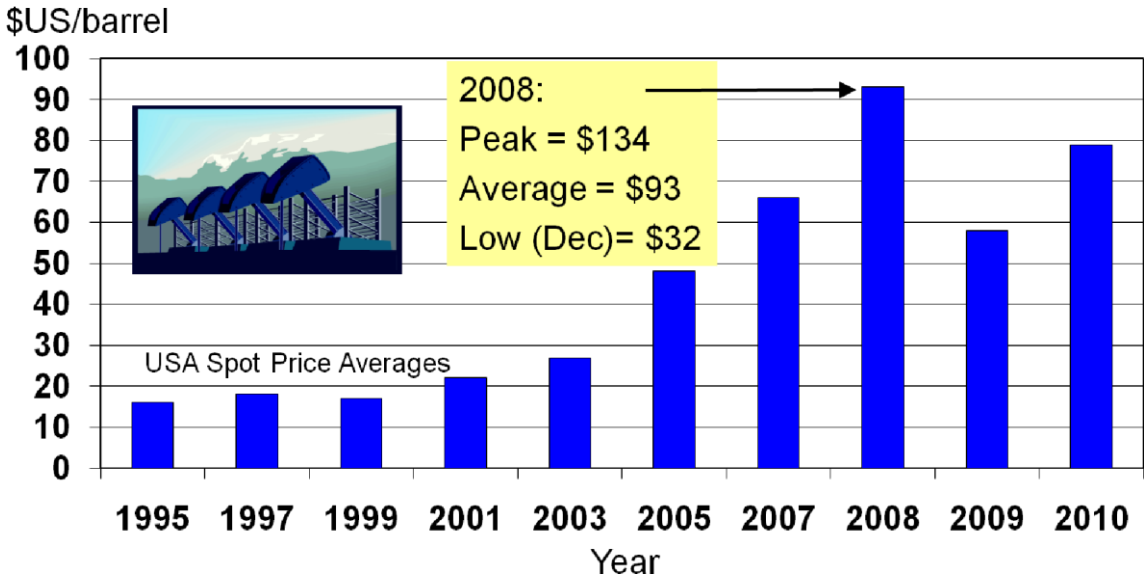

Figure 1. Rising Price of a Barrel of Oil.

This expanding industry is also highly profitable: Exxon Mobil, the world's largest nongovernment owned oil group, announced profits of $US30.5 billion in 2010, and revenues

[1] Billion = 1000,000,000. Trillion = 10^{12}. 1 cubic foot = 0.0283 m^3. Quadrillion = 10^{15}. 1 Btu = 1,055 J.

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of $US383 billion. These profits are expected to continue into the foreseeable future, as the price of a barrel of oil will remain high.

1.2 Pipelines in the Oil and Gas Business… Boom

To support this growth in energy demand, pipeline infrastructure has grown by a factor of 100 in approximately 50 years. It has been estimated that world pipeline expansion will be in the order of 7%/year over the next 15 years [2]. This means over 8000km/annum of pipelines being built in the USA alone, at a cost of $US8 billion/annum [3].

Internationally, 32,000km of new pipelines are constructed each year: this is a $US28billion business, and 50% of these new builds are expected in North and South America [4]. Additionally, 8,000km of offshore pipelines are being built per year: this is a $5billion business with 60% in NW Europe, Asia Pacific, and the Gulf of Mexico.

Figure 2 shows the predicted 157,000km of onshore pipeline systems to be built in the next 5 years (2008-2012) at a cost of $US178billion.

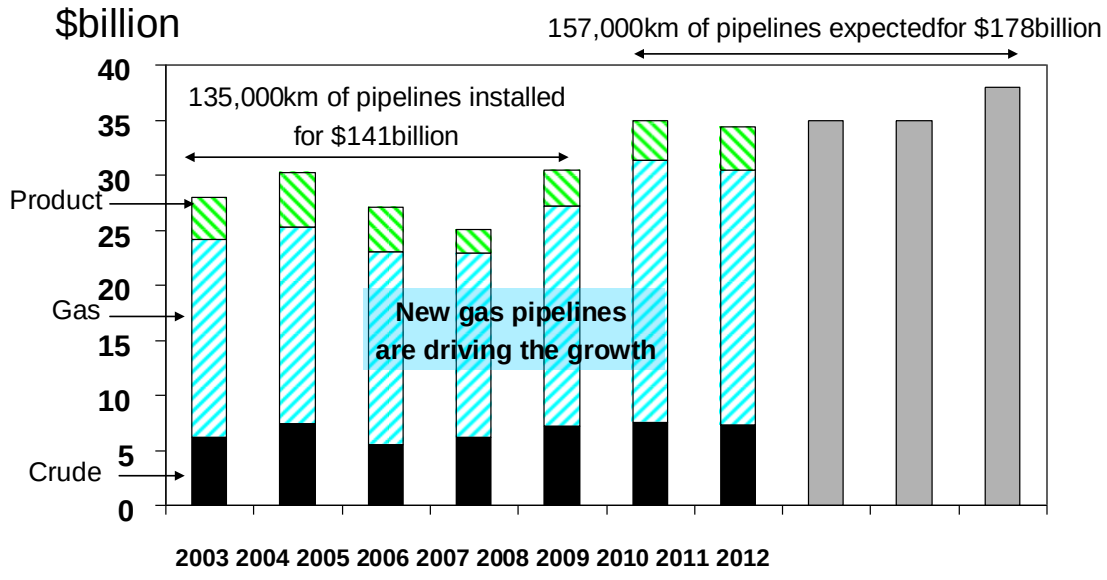

Figure 2. New Onshore Pipeline Constructions [4, 5].

1.3 Engineers in the Oil and Gas Business… Recession

The oil and gas business is a highly profitable business, and will continue to be profitable into the foreseeable future, but it has major problems with its workforce. Consider these diverse facts and quotes [6, 7] related to the oil and gas business:

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- In the USA there are 1,700 people studying petroleum engineering in 17 universities, compared to 11,000 in 34 universities in 1993;
- *"There has never been a time when our industry so needs outstanding talent. Older professionals will need to be replaced in a few years. At the same time we have seen a drop in students taking science-based programs in the United States'*, Rex Tillerson, CEO, Exxon Mobil;
- *"We need to convince young people that a technical career in this industry is both stimulating and worthwhile – meeting challenges that matter to the world'*, Jeroen van der Veer, CEO, Shell;
- The average age of an American oil worker is over 50, and the average age of a worker in major oil and gas operators and service companies is 46 to 49 years of age.

Fossil fuels are essential, and the oil and gas business relies on engineers for everything from safety to profits, but the simple fact is that this business faces a crisis. It is not attracting new engineers, and much of its workforce will soon retire. Why has this situation arisen, and how can it be resolved? This paper attempts to answer this important question, and discusses how education and training can play key roles. The paper focuses on engineers, but there is also a shortage of good pipeline technicians and operators.

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2. THE SKILLS GAP, AND CRISIS INDICATORS

2.1 Ageing Workforce in the Industry [6, 8 – 11]

The oil and gas industry workforce is old: a 'young' worker is about 43, and an 'old' worker is 55. Their average age is about 50 and their average retirement age is 55; therefore, it is obvious that the industry faces a major skills crisis in the next 5 to 10 years, as more than half the experienced workforce will leave the industry.

It is all skills levels that are ageing. In the UK, the mean ages of Chartered engineers and Incorporated engineers is 55, whilst the mean age of Engineering Technicians' is 50. Over 25% of the Chartered Engineers are aged 65 or over.

2.2 The 'Missing Generation'

We are all aware of the 'missing generation' in the oil and gas industry. The workers who trained in the 1960s and 1970s are approaching retirement; but the new, young generation attracted to the industry by the current boom and huge salaries are still too young to replace the retirees. Replacement takes time: it takes about 3 years for new staff to become familiar with the industry, and about a further 10 years to gain a professional discipline [6].

2.3 Increasing Global Demand for Skills

The skills problem is becoming even larger: we need to replace the missing generation, plus introduce another generation to meet with increased demand for skills. This is because new oil and gas finds will require huge workforces; for example, Brazil's Tupi field is equal to all the reserves in Norway. Also, the shift from the rapidly depleting older fields in the Middle East, to the new discoveries in places such as Canada, will create a global recruitment problem.

Reference 6 quotes, *"Faced with one of the biggest periods of expansion in its history, the global oil and gas industry is already being held back by its failure to attract, recruit and retain highly skilled staff. This is true from rig workers to senior scientists and engineers. Through short-term thinking and a belief that required staff can be bought, the oil and gas industry has stretched its resource base to breaking point."*

2.4 Reduced Number of Engineers in the Industry

There has been a lack of training and development in recent years, and there are many reports on the dwindling number of engineers in the business [12 – 16]. In the UK, the total number of registered engineers has fallen to 25,000, or by 8%, in the past decade [11].

In 2007, the UK's Association of Consulting Engineers (ACE) commented, *"There are currently 20,000 unfilled jobs in the consultancy and engineering sector. 13% of all jobs are*

currently vacant; highest numbers of vacancies are at engineers' level and especially so for civil, electrical and mechanical".

2.5 Short Term Fixes

Many companies are having to boost their work force with workers on highly priced, short term contracts, or tempting back retirees. This is a short term fix, of no longer term strategic value to a business.

Similarly, companies are recruiting staff from developing countries who are maintaining their production of good quality engineers. Again, this is a short term fix, as the engineers recruited from these developing countries create a skills gap in the country they are leaving, and many will eventually return home.

2.6 Loss of Skills and Cost of Products

There is an accepted shortage of all key skills in the industry. The impact in the pipeline business is manifesting itself in the cost of pipelines; for example, the nominal price for a mile (1609m) of 36 inch (914mm) diameter pipeline in the USA had risen from $US1.5million/mile in 2003 to $US2.5million/mile in 2005, primarily due to the increase in the price of steel ($650/t to $US1300/t) and a scarcity of qualified workers [17]. Recent data in the Oil and Gas Journal give the following increases in costs for building pipelines [18]:

	2006 (US$/mile)	2007 (US$/mile)
Materials	728,000	>1,000,000[2]
Labour	629,000	1,000,000

The increase in labour costs is attributed to a shortage of highly skilled tradesmen (welders, sideboom operators, etc.), an ageing workforce, fewer young people entering the field, and many competing projects. The effect is that the cost of building a pipeline has nearly tripled in the past four or five years from approximately $1,000,000/mile to $3,000,000/mile [18].

[2] Mainly due to rising costs of steel.

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It is not just the oil and gas business that has this age problem, and lack of new blood; for example, in the UK across all industries 25,000 engineers retire annually and only 12,000 graduates replace them.

2.7 Lack of New Blood

In the UK, a recent survey [19] on the oil and gas business revealed that more than three quarters of companies in the oil and gas business are having difficulty recruiting staff (both managerial and technical), and part of the problem was the industry's poor image (job insecurity, old employment practices, lack of experienced staff).

Many developed world countries are also faced with a decline in the number of schoolleaving-age pupils: in the UK there will be a decline of about one in six in that age range over the next decade [11].

2.8 Decline in Engineering Graduates

The total number of UK engineering and technology graduates over the last six years has remained stable [11, 20]. However, the growth in other degree subjects has resulted in a decline in the overall share of all students: a decline from 9% to 6% [8]. Additionally, new engineering/science graduates are decreasing by 3% every year in the UK. A report in 2007 [21] demonstrated that students in the UK are opting out of science, technology, engineering, and mathematics subjects at university, and similarly there is a decline in high school students taking these subjects.

The UK's Royal Academy of Engineering in 2007 gave a more telling commentary of engineering graduates: *"Between 1994-2004 the number of students embarking on engineering degrees in UK universities remained static at 24,500 each year even though total university admissions rose by 40% over the same period. Further, after completing their studies less than half of UK engineering graduates subsequently choose to enter the profession*".

2.8.1 The Need to Employ Local Nationals

State-run companies in the Middle East and Asia have identified the reliance on expatriate workers, and the need to develop their own skills base. These countries/companies are now systematically employing nationals, with the intention of replacing the existing foreign and ageing workforce, Figure 3.

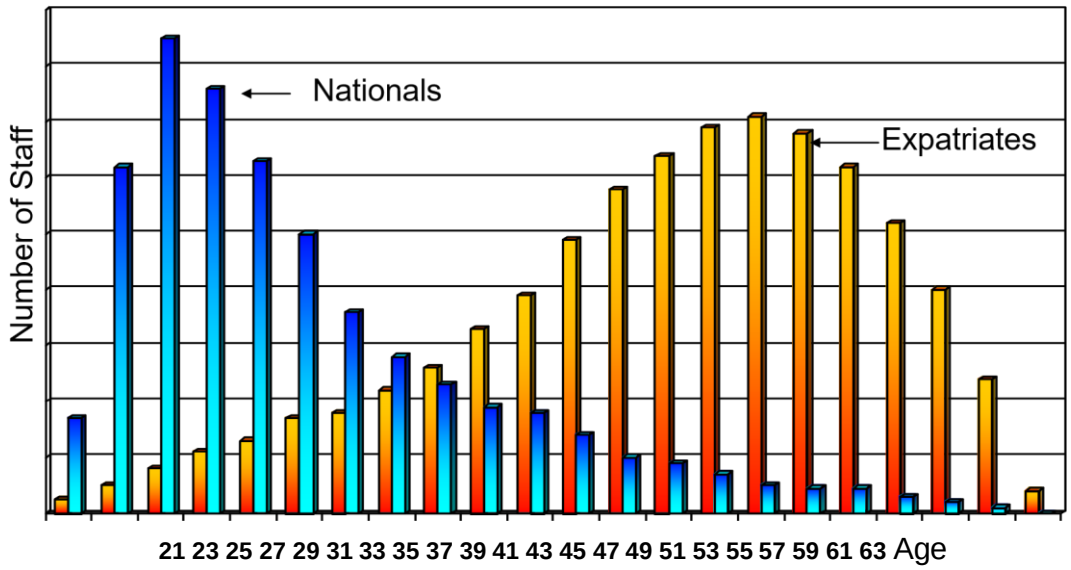

Figure 3. 'Push' by Middle East and Asian Countries to Replace the Expatriate Workforce with Nationals [6].

This means organisations have to make large numbers of new recruits 'job ready' quickly [6], but this influx of inexperienced, albeit able, staff require training, mentoring, etc., by the older, existing expatriate workforce. There latter workers are overworked, short staffed, and many may be looking forward to retirement; therefore, they are unlikely to be able to spend the necessary time with new staff to help them develop quickly.

2.9 Responsibilities[3] and Liability

Now, governments are requiring that engineers should be demonstrably trained and competent, Figure 4. For example, the USA Pipeline Safety Regulations Federal Register Part 49 CFR §192.763 (*Pipeline integrity management in high consequence areas*) states:

- Training (i) Supervisory: '*An operator's integrity management program must provide that each supervisor… has appropriate training or experience in the area for which the person is responsible…'.*
- Training (ii) Persons who evaluate: '*An operator's integrity management program must provide criteria for the qualification of persons who review or analyze results from integrity assessments and evaluations…'.*

[3] See References 16 and 24 for commentaries on ethics in engineering.

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Figure 4. The Training of Engineers is Becoming a Regulatory Requirement.

Consequently, our business is now formally requiring we train our engineers correctly and comprehensively. Life-long learning is a legal requirement, and standards are being produced to help pipeline engineers meet these expected competencies [25].

2.10 Other Issues for the Industry

References 3, 10, 11, 22 and 23 have covered the many problems with the oil and gas business, and the pipeline business, and hence the reader is directed to these publications for further reading.

3. HOW CAN EDUCATION AND TRAINING HELP?

This paper has presented exhaustive data to show the reader the skills crisis in the oil and gas business. How can we improve and attract skills in our industry? The previous section has shown that many things have to change before we can attract new, young staff (image, remuneration, job security, etc.), but this section will focus on education and training.

3.1 Change is Essential and this Requires Training

The engineering profession is under increasingly pressure to change [26, 27] for a variety of reasons; for example:

- The environmental and economic problems facing the global society need new solutions;
- New discoveries, powerful computers, and fast communication systems have revolutionised the profession;
- The traditional boundaries between mechanical, civil and electrical engineering no longer exist, and should not exist.

Indeed, the USA's National Academy of Engineering reported in 2004 and 2005 the important decision-making role engineers have in society and the need for engineers to have broad, flexible perspectives: integration of skills is essential. This will need learning tools and easily accessible, searchable, knowledge bases.

3.2 Training is Good Business

Reference 12 noted that employer-sponsored training and education is a major attraction for young staff looking for jobs. Workers say they are more likely to remain with companies that invest in training programs. Additionally, investing in employees skills through training is a more effective tool for retaining staff than purely financial incentives.

3.3 Overview of Training Tomorrow's Engineers

Is the present education and training system failing industry? Andrew Furlong, of the UK's Institution of Chemical Engineers commented on the *"looming skills gap in science and engineering"* in 2007 and expressed concern about meeting the UK's need of 2.4 million new science and technology graduates by 2014.

Most commentators believe a radical rethinking of strategy is needed. One view is that the main requirements that must be implemented for the successful training of tomorrow's engineers are [26]:

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- UNIVERSITIES: Universities must have education and courses that bridge cultures across the world as growing internationalisation is reflecting the global nature of business.
- MODULAR: Modular training courses and infrastructures offer convenient, efficient, flexible, life-long learning.
- PRACTICAL: Learning must have a practical orientation, where there is an integration of education and application.

3.4 Do we know what Young People and Engineers want?

The above three requirements present a challenge: at present we do not have training that satisfies these requirements in either the oil and gas industry, or the pipeline business.

One of the problems we have in the education business is that we have a poor knowledge of our customers' needs and requirements. Today's students and young engineers want flexible, efficient, rapidly-accessible, up-to-date learning, but often we give them what middle-aged, male engineers or academics believe they need.

A Master (MSc) programme in pipeline engineering was launched in 2000 in the UK. Paper mail shots, posters, etc., were sent out and displayed. Yet, all the students who applied for the course came via the internet, having discovered the course on the university's website. The 'client' was not on any paper mail list, did not look at posters, and investigated further education in parallel with buying their music from eBay, booking a flight on expedia.com, and reading their favourite newspaper – all on-line. The client was surfing the web for his/her future education course, while the university were pinning posters to university noticeboards!

Similarly, today's students and young engineers want materials quickly, and in electronic format. They want: material that can be quickly interrogated by search facilities; good visual materials; up-to-date information; and instant, remote access to the learning materials whenever they need them. Future classroom-based teaching, and library-based references, need to adapt to the new students, or risk becoming unused or even obsolete.

3.5 Alliances between Academia and Industry

We cannot expect universities to know what an industry needs. Universities are battling for funding, competing for students, and are facing their own challenges. They are as busy as any other industry.

If we want academia to meet our needs, we have to inform them of our needs, and actively support them in their provision of education, research and training that solves our skills problem.

A joint endeavour between industry and education must be realised if we are to have viable products and solutions, and it is industry that must be proactive.

3.6 A New Learning Approach to Overcome the Old Barriers

A four tier approach to improving our intake of good young staff, and training our existing staff, is needed.

3.6.1 Tier 1: Working with Schools

We need to attract good young students into our universities, and stop the decline in engineering graduates: engineering graduates from UK universities are decreasing by 3%/annum. A partnership of industry, professional institutions, schools' career advisers, and universities is needed.

3.6.2 Tier 2: Working with Universities

Industry needs to work closely with universities and build new courses that are tailored to the industry needs, and attractive to young people. The universities can then ensure academic standards are met.

Change will be needed; for example, many first engineering degrees are being 'diluted' by the inclusion of topics that are considered more attractive to younger people (marketing, management, IT, etc.), at the expense of more traditional engineering topics [28]. Institutions that accredit these degrees need to question this type of change.

However, the universities are only reacting to what they see as market forces, and the wishes of their entrants. This dilution continues into postgraduate degrees, where many masters programmes offer various engineering courses 'with management'. Is there a world shortage of managers? Engineers need management training – but do they need it in their early 20s? The end products of some of our degrees are new engineers with a bias away from engineering, and a view of engineering that leans to IT, management, etc., rather than the traditional subjects. Is this what industries need?

Universities also need to consider how they present oil and gas engineering, and pipeline engineering at both undergraduate and post graduate level. The market needs these engineers, and they are not emerging from our universities. Industry needs to talk to universities!

Pipeline engineering is poorly presented at universities. Undergraduate engineers should be offered both oil and gas, or pipeline, engineering options in their final year of study. The oil and gas industry needs to help universities develop materials for these options, educate the academics, and be seen by the students to be actively supporting the options.

Some universities (for example, Newcastle, UK; Calgary, Canada; Rio, Brazil) are now providing formal learning programmes in oil and gas pipelines [22]. Additionally, some universities conduct ad hoc research into pipelines, some have centres of expertise in testing (for example, University of Gent, Belgium), and some universities have dedicated posts in pipeline engineering (for example, University of Loughborough in the UK has a professorship in pipeline technology).

3.6.3 Tier 3: Modular Learning

Engineering is rapidly changing, and engineers need to keep pace with all technical changes. This is not possible without life-long learning. Additionally, the days of a 'job for life' are over. All engineers need to be highly trained, to be able to move between jobs. Structured modular training courses can provide this learning.

Globalisation, fierce commercial competition, and changing technologies require engineers to be quick to react. Similarly, engineers need to have easy and quick access to new knowledge. This can be achieved now: the modern methods of flexible working can allow us to take modular courses. This can give us the vital work-life balance we all now see as essential.

Staff no longer want to spend long periods away from home and workplace; they would rather embark on modular learning where they select suitable training packages from a comprehensive list, and participate in that learning programme in their own time.

Many companies offer short (up to five days) public training courses on a wide range of pipeline engineering topics. There are regular public training courses held in Amsterdam, Houston, Kuala Lumpur, Calgary, etc., on such topics as: Onshore and Offshore pipeline engineering; Pipeline defect assessment; Pipeline inspection; Pipeline repair; Corrosion assessment; Risk management.

These short courses are popular, and play an important role in training staff in the pipeline business. Some are highly reputable, but they are not regulated, accredited, examined, or co-ordinated. Consequently, the oil and gas industry, and academia need to work together to produce and offer regulated, accredited, and examined modular learning. Modules related to current and future industry issues should be on offer. This will require universities and industry to be flexible in both providing learning and providing students.

3.6.4 Tier 4: Distance Learning (e-learning or Virtual Learning Environments)

Universities need to offer residential, part time, and distance learning packages for all their possible customers (undergraduate, post graduate, and continuing professional development). This flexible, distant learning approach is in line with the changing work place, and the expectations of both the young and old today, and will appeal to both young engineers wishing to enter the oil and gas industry, and existing staff in the industry.

The internet offers the platform for both modular courses and distance learning. Distance learning formats can be easily produced, albeit at a price, but the distinction between campus learning and distance learning is fast disappearing with the advent of 'virtual learning environments' (VLE).

VLEs are internet-based 'platforms' – software that organises all the information needed for distance learning. The platforms can be commercial (you pay) or 'open-access' (free), and allow staff and students to log-on and access all course materials, bulletin boards, chat rooms, information updates, announcements, libraries, etc., in an easy, user-friendly web page format.

There are a number of commercial VLEs [29]: we now have the technology to offer distance learning to the oil and gas industry. Now, we need to:

- Produce the learning modules;
- Produce experienced staff to supervise the modules and students;
- Place the modules on a suitable platform;
- Manage and maintain the learning.

3.6.5 Barriers and Solutions

What are the barriers to this four tier approach? There are several:

- Professional institutions and societies must reverse the decline in engineering graduates by improving the image of the profession, lobbying for higher pay particularly for new starters, etc..
- Industry must commit to both support and participate in modular learning packages;
- Distance learning modules must be produced under partnerships between industry and academia;
- The industry must produce teaching staff to supervise these learning modules;
- An infrastructure must be put in place to give access to these modules;
- The whole process needs to be managed and examined.

4. THE FUTURE: CONTINUING PROFESSIONAL DEVELOPMENT AND DISTANCE LEARNING

This paper has emphasised that there is a shortage of pipeline engineers, and that universities and companies should establish partnerships in order to contribute to the training of young professionals in this area.

As students are changing, and funding is changing, then so are the requirements of the labour market. Academia need to actively respond to these changes by the introduction of more flexible programmes to be offered to work-based learners and part-time students.

The two key changes needed are a move to continuing professional development (CPD) and distance learning.

This section covers CPD and how it can improve learning in the workplace, and also the move to distance learning.

4.1 CPD

Professionals are expected to continually update their knowledge and skills [30]. CPD – Continuing Personal or Professional Development - is the term [31] that describes a commitment to structured skills enhancement and personal or professional competence [32]: *"These courses comprise various forms across universities, colleges and companies – from short courses to doctorates. CPD offers the individual the opportunity to take the type of course they require in order to enhance their knowledge and experience - supporting them in fulfilling their own career aspirations. At the same time, the learning acquired is designed to meet the current and future needs of engineering employers and their industries".*

The gains for keeping up-to-date are high, as are the potential dangers from failing to do so [33].

Academia appreciate the needs... Prof. Nick Lieven, from University of Bristol states*: "The faculty works closely with the industrial sector, especially with respect to research activities. However, there is also a national need within industry to improve the skills and knowledge of many employees, a need that can be met by tailoring learning requirements to the individual– using CPD opportunities"* [32].

As more courses are made available, more local companies can be involved, and further funding can be secured in different forms, such as the provision of these companies of occasional students. This additional revenue can support any improvement activities required for the successful delivery of the CPD courses.

4.2 Goal of CPD Courses

CPD courses should aim to maximise the impact of short courses attended by engineers, particularly in order to encourage 'reflection' (how they can improve their own practice, after they have completed a course), and ensures there is a difference in the practice of the participant after they have been on the course, demonstrated in improved or changed behaviour in practice [34].

4.3 The Need for 'Flexible Learning'

It is important to remember that today's learners are more sophisticated, and as they carry a 'client attitude' they demand up to date efficient services due to their time-pressed lifestyles and stress-related jobs [35].

'Flexible learning' means students learn at their pace, with appropriate guidance, and it compliments traditional teaching. Flexible learning aims to provide the new generation of students with a new format of delivery, which will take into account their interests and demands [36]. There are several reasons for moving towards flexible learning:

- we need to cater more flexibly,
- needs for collaboration between providers of education and training,
- provision of curricula in packaged form,
- large class numbers and new target groups,
- mature and non-traditional entry students,
- etc..

4.4 Flexible Delivery – Online Distance Learning

Online distance learning is the preferred form of delivery to allow flexible learning. The complete course materials are presented as a series of topics available through different elearning tools, which are accessible online.

It has been reported [36] that students "learn by doing", and this is the heart of flexible learning. In order to account for this, students should be encouraged to work during, and after their lectures (exercises, discussions, etc.).

Each topic is presented in 'bite size' sub-topics, allowing the students to structure their learning plan. Quizzes are introduced after the main sub-topics to ensure students have completed the specific learning outcome of the sub- topics.

Online help is available, and support is provided by experienced tutors who deal with students' queries during their learning experience.

Students are also encouraged to create a student community, where they can discuss different aspects of the module. This will enable students to become part of an online cohort, which will positively contribute to the student's journey.

This online delivery fits in with today's students and busy workers: it can be incorporated into their personal and work timetables, rather that interrupt and interfere with their timetables, as they increasingly find with residential teaching.

4.5 'Credit Accumulation'

CPD can be simply a learning process for staff, but it can also lead to academic qualifications. CPD courses can be accredited by universities, and be awarded credits towards formal academic qualifications.

As Prof. Alan Day, of Bath University states: *"For many students the option of studying a short course which provides the opportunity to transfer to an MSc programme at a later stage is very attractive. CPD programmes strengthen our links with industry and broaden the attraction of existing MSc modules."* [32].

4.6 CPD Courses

There are many 'courses' available to engineering staff, but most of these courses are not accredited by recognised bodies such as universities or trade bodies. Universities offering CPD courses would be expected to have processed their course contents and trainers through high levels of quality assurance. Hence, there is a clear need for accredited training courses. This leads to three possible ways forward:

- University Full-time, Residential Courses: In engineers' busy schedules, it is difficult to commit to formal full time education. Academic institutions should offer alternative flexible education to allow professional engineers to widen their knowledge and potentially gain further qualifications.
- Public Training Courses: The provision of CPD courses in pipeline-related areas is limited, and accredited courses are not readily available. This means that staff do not have enough opportunities to improve their skills as part of their continuing professional development.
- Flexible Learning, by On-line Distance Learning: Online distance delivery of short courses are a preferred model in today's "online" world. This is an attractive and modern way of flexible delivery which will reach students all over the world, while

they keep their roles, and improve their skill. Academic accreditation of these courses will allow staff to demonstrate a competence and ensure high quality in delivery and learning.

A clear skills gap has been identified, and a 'learning' gap has also been identified. Universities and the industrial sector need to urgently partner to create current and flexible programmes that can fill these gaps. Companies need to support the sector by investing in their staff education: this will mean they can demonstrate staff competency, a primary requirement in today's business.

4.7 The Start...

Penspen Ltd., UK, and Northumbria University (School of Computing, Engineering and Information Sciences), UK[1], have teamed up to launch a fully-accredited, online Distance Learning Certificate in Pipeline Engineering. Penspen[2] and Northumbria created the Postgraduate course, which is worth 33% of an MSc, based on the reviews in the paper, and a previous paper [22]. This is the first course of its kind and a market-leader, its development primarily driven by the skills-crisis within the industry.

The course's unique advantage is that it is fully flexible, with students able to learn via a dedicated online training website which can be accessed by students across the globe.

The Certificate is made up of four modules worth 60 academic credits, meaning participants can ultimately go on to put their credits towards a Masters worth 180 credits if they so wish. The first course commences in October 2011, and it is already proving very popular with a large number of registrations. The first module will be 'Pipeline Integrity Assessment'. During academic year 2011-12, further modules will be added in Onshore Pipeline Engineering, Risk Management of Pipelines, and Materials and Corrosion.

5. CONCLUSIONS

There is a skills shortage in the oil and gas business, and an urgent need to provide education and training to a number of its sectors, including pipeline engineering.

This paper has reviewed current education and training provision in pipeline engineering, and identified a number of gaps, and shortages. It has recommended a radical new approach to training and education: flexible learning, through online distance learning from

[1] http://www.northumbria.ac.uk/sd/academic/ceis/enterprise/penspen2/
[2] http://www.penspen.com/Services/Training/Pages/PCPIM.aspx

accredited training providers. This is the future, and satisfies the needs and expectations of today's students:

- Flexible;
- On-line; Distance learning;
- Accredited.

This radical approach will not be easy to adopt: distance learning materials and delivery are both expensive and complex. However, it is mainly a matter of finance, and it is the industry who needs to provide the support.

Penspen Ltd., UK, and Northumbria University, UK have partnered to provide the world's first fully-accredited, dedicated, on line Certificate in Pipeline Engineering. The industry is asked to encourage these types of initiatives.

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