



CREDIT: SEB GREEN. WINNER OF CHEMICAL ENGINEERING PHOTO CONTEST (PG, SCIENCE)

THE
PIPELINE

IN THE PIPELINE

A NOTE FROM THE PRESIDENT

Hello All

REGISTER TO VOTE, and GO TO FRANK MORTON.

That's the important stuff done. Here's some more thoughts.

A couple of pieces of news to share with you - the Department's very own **Prof. Stephen Richardson** recently took over as **President of the IChemE** (go Imperial Mafia). Also, **Florence Gschwend** won **Young Researcher of the Year** at the IChemE Global Awards, so we have both ends of the seniority scale at IChemE sewn up.

I found Shell's discussion (p18) interesting, but I invite everyone to consider, **based on the first and second laws**, whether electrolysing water to produce hydrogen, then reacting that with CO_2 , then burning it in an internal combustion engine, compares with using those same electrons to... charge a battery and drive an electric motor.

Regarding voting: you can register to vote at both your home and university constituencies, but you must only actually vote in one. I urge you to consider where your vote has the greatest impact. **Regarding Frank Morton:** when Imperial sends a big team to Frank Morton, we inevitably do very well. Let's try and do that this year.

CONTENTS

CALENDAR.....	3
PICTURE PAGE.....	4
IR.....	5
XMAS DINNER AD.....	6
DMCs.....	7
SPORTS	8
TOUR AD	9
WELLBEING.....	10
UNCLE B.....	11
CHAT WITH AN INTERN...	12
CHAT WITH A GRAD.....	14
CHEMENG CONVS.....	16
INNOVATION IN	
INDUSTRY (SHELL).....	18
THE BRIEFING.....	21
PUZZLES.....	22
SOSH MEDS.....	24

Paul

A NOTE FROM THE EDITOR

Hey everyone

In between staring at a photocell for eight hours and preparing stock solutions, I've been creating this Pipeline especially for you.

I am the one responsible for those Uncle B posters around the Department. Yes, it's my fault. I hope you got your frustrations out. Uncle B has replied to some of your comments, too.

Look out for our interviews - we have one of our most illustrious alumni giving us an interview. She is the HEAD of engineering, full stop. She has so many awards that I cannot create a large-enough 'Humble Brags' section.

In other ChemEng news: congrats to our new secretary, **Douglas Lau**. Also congrats to our new year reps. Well done for winning an election - that alone takes ***bare effort***.

Kathryn

CALENDAR

STAY CONNECTED

BY DESPOINA RIGOU

Tuesday 26th November, CPSE



Board Games

Are you a keen player of board games? Do you need a break from the pre-Christmas deadlines? *ChemEngSoc will take care of you.*

We are running family games evenings, centred around bonding and parental advice. Who will play? Family vs family!! What games? **Pictogram** and **charades!** And on top of that?? **Two evenings** to pick the one that best fits your family's schedules!! There will be snacks and drinks - so come along early to **secure yourself a post-lecture snack.**

More details to follow – keep an eye out around department!

Monday 2nd December, 7:30pm, The Bull



Christmas Dinner

Ho ho ho! Are you a Chemical Engineer and you like festive Christmas dinners? Yes, us too! Join us for the most exciting Christmas dinner of the year at **the Bull**, a cosy British Gastropub in Westfield on Monday 2nd December, 7.30 pm.

We have organised a **festive 3-course meal** with wine and a **prosecco reception.** What makes it better? **Choose your own seating position in advance!** We are heavily subsidising tickets to **just £30pp.**

Tickets are **already on sale...** and they may already be sold out by the time Pipeline is released. **Don't miss out!**

Wednesday 11th December, 7pm, various

Pub Crawl

With **only two days left of term**, this is the perfect excuse to ~~get hammered~~ get an in-depth tour of Chelsea and Fulham. Some of us have frequented this route for years. And in the case of lecturers – aeons.

All are welcome – bring your families, your research groups... or just yourself. This is your chance to live it up and party like there's no coursework deadlines the day after.

Provisional route: Union (7pm) → Chelsea Pensioner (8pm) → Kona Kai (8:40pm) → Oyster Rooms (***Spoons***) (9:30pm) → ***SLUG*** (10:30pm).

Slug is ***life***. Make it there, and you will be rewarded.

Tuesday 7th January, Thursday 9th January

Ice Skating on the go!

It's time to skate  away your problems, and break the ice with your fellow ChemEngers. This year, you can get a ticket  for just **£5 per person – over 50% off.** And you get **one drink FREE***.

This event is divided into individual, one-hour year group sessions:

Tuesday 7th January for 1st and 2nd Years

Thursday 9th January for 3rd, 4th Years and MSc

Only **10 tickets** are available for each year group. Tickets will go on sale **18th November** and will end at midnight of 15th December.

**choices ranges from non-alcoholic hot drinks, to house wines and beers*

PICTURE PAGE



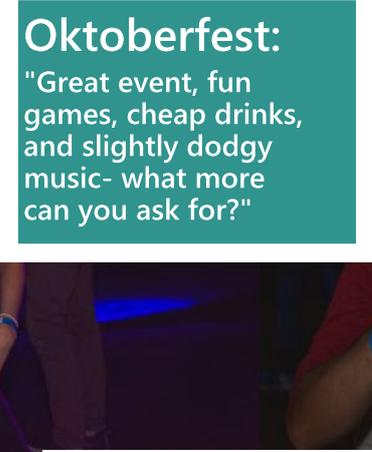
MSc Welcome Dinner
"A great opportunity to get to know everyone in class."



UG Welcome Dinner
"Ognisko easily beats QTR"

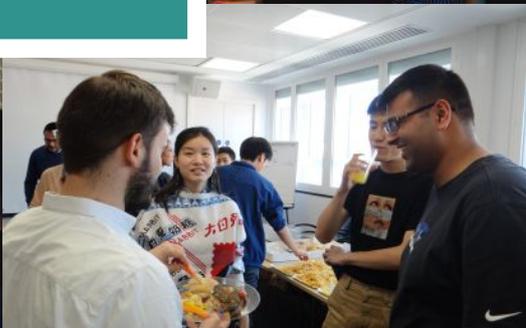


Oktoberfest:
"Great event, fun games, cheap drinks, and slightly dodgy music- what more can you ask for?"



Y4 Lunch:
"Good selection of bagels"

Family Feud
"The tab ran out too quickly."



INDUSTRIAL RELATIONS

FIELD TRIP

Have you ever wanted to experience what a company is like for yourself? Now you can. Shell, OSIsoft and Astrazeneca have opened their doors to the people of ChemEngSoc. Seize the day, everyone.

SHELL: HOW TO ACE A VIDEO INTERVIEW

TUES 19TH NOV, 6PM, ACEX DESIGN OFFICES - SIGN-UP REQ

We know how you feel: video interviews are horrible. Shell wants to help you get through this stage. **Shell HR and engineers** will be on hand to help you hone your technique, including **live video interview practice**. And if that wasn't enough... **free dinner**.

Sign-up here: tinyurl.com/ShellVideoInterview

CAREERATHON

THURSDAY 21ST NOVEMBER, 6PM, CPSE (RODH LEVEL 6)

It may sound like new event for the Olympics, but this is your chance to meet **past alumni** from the department. Alumni go into all sorts of careers: **finance, consultancy... some even go into engineering**. You can speak to people with **industrial experience**. Get those business cards ready.

TRIP TO OSISOFT OFFICES + FREE LUNCH

WED 27TH NOV, OSISOFT PADDINGTON OFFICES - SIGN-UP REQ.

OSIsoft manufactures software for all types of industry to capture **real-time data**. We're talking **data visualisation**, we're talking **data analysis**. All the industrial ***big bois*** use this software - this is what you need to be top in industry.

This is your chance to find out more about the company. You will get **free lunch** and an **opportunity to network** with people at the company. Plus: ***procrastinate***.

Want to hear more? Read our chat with Ian, who interned at OSIsoft this summer.

CGCU: FACES OF ENGINEERING

THURS 28TH NOV, 6PM, CLORE LECTURE THEATRE (HUXLEY)

CGCU has co-ordinated this discussion in collaboration with **ChemEngSoc, EESoc, BioEngSoc and DoCSoc**. A panel of engineers from companies such as Shell, Qualcomm, and Bloomberg will discuss diversity in engineering.

The panel discussion will be followed by **catered** networking with the panelists.

Get tickets here: is.gd/fKLkan

ASTRAZENECA TRIP

28TH-29TH NOV, AZ MANUFACTURING FACILITY (MANCHESTER)

ChemEng on tour. This is the first **overnight trip** of the year. Make us proud.



Christmas Dinner

ChemEngSoc Presents...

~A Christmas to Remember~

2nd DECEMBER, 7:30pm
THE BULL, WESTFIELD

- 3 course meal with wine
- Prosecco reception
- Choose your own seats

Dress Code: Smart



HEAVILY SUBSIDISED TICKETS

£30 pp

Tickets out on 11th
November – watch
your email!

FOLLOW US FOR UPDATES!
chemengsoc.com | @icchemengsoc



DMCs

'DEEP MEANINGFUL CONVERSATIONS'

BY KARYSHMA GILL

I've been thinking about migration and nationalities a lot lately - particularly about the ideas of passports and visas, as well as what nationalities signify.

I think, to an extent, that there is an unwritten hierarchy of nationalities. We're repeatedly told that we can be whatever we want to be, but some of us realise early on that a lot of our options are constrained by a piece of paper that we don't have any control over. And I think, to an extent, that realisation is often accompanied by a lot of frustration. This is why Brexit and the recent human trafficking case in Essex are such polarising issues. They force us, as a large, diverse society, to examine our privilege, our perspectives and - more importantly - our values as a society.

Imperial has always been pro-diversity and I think our department is a good representation of a wide range of people. It's important for a subject like chemical engineering to be grounded in professionally- and culturally-diverse experiences. As such, this edition will explore what undergraduate students in our department think of migration, especially in cases like Brexit.



This probably sounds politically incorrect, but I think Brexit has evened out the playing field between Europeans and other overseas students. It's going to cost the same for us to get hired as an European student, which means that I now have a better chance of getting hired.

Y2 UNDERGRADUATE

This probably sounds really mean but I don't care. ChemEng, labs and internship applications too much as it is without worrying about Brexit and the state of Europe. Politics is basically buffoons making decisions for the rest of us... and they wonder why democracy is overrated.

Y3 UNDERGRADUATE

Don't go into finance, they say. But back where I'm from, there are no jobs in chemical engineering. Not that there are tons here, but still a bit more. I just want to get a better life, and you know, live in London. London's pretty great - there are so many things to do, so many things to see and it just has a life of its

Y4 UNDERGRADUATE

At this point, I feel that Brexit just isn't gonna happen. I'll be out of university, in a cushy job, earning my millions, having paid off my student loans - and we'll still be negotiating with the European Union.

Y1 UNDERGRADUATE



SPORTS

FRANK MORTON 2020 NEWS

BY JAMES MORRISSEY

Hello all,

We can confirm the date of Frank Morton 2020 as **Monday 17th February**.

We have been given both the 17th February **AND** the morning of the 18th off!!! i.e. there will be no lectures scheduled for all of Monday and Tuesday morning.

This is all the more reason to not miss out on FM2020.

Tickets will be on sale shortly so keep an eye out.

Additionally, the **FM t-shirt design competition** is now open. look out for the design template in your emails. You can make any changes to the template that you wish; we're looking for ChemEng-related **jokes/puns/memes**.

Submit the designs to me at rjm216@ic.ac.uk. Nothing too offensive as these will be rejected. (It may be funny. We still can't use it.)

The winner will receive a free ticket to FM2020... and has the chance to meet Serena from off the Apprentice.

James

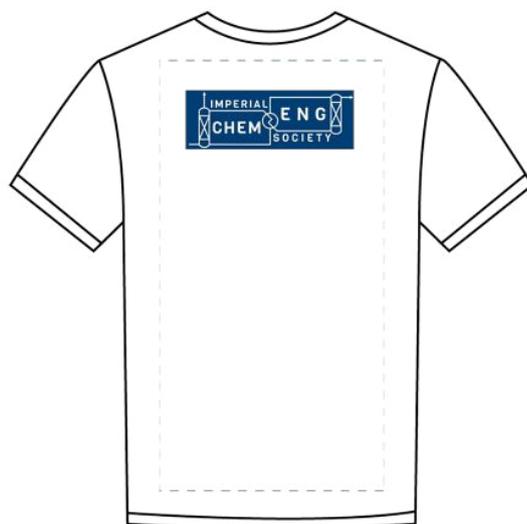
Chemical Engineering Sports Officer

WINNING DESIGN?

FRONT



BACK



NAME: _____

EMAIL: _____

TOURS 2019-20

AT CHEMENGSOCS PLANS ARE UNDERWAY
FOR A NUMBER OF INDUSTRIAL VISITS

UPCOMING TOURS

- **Shell Learn and Lunch**
- **AstraZeneca site visit**

WATCH OUT FOR SOON

- **OSIsoft Offices**
- **ExxonMobil - Fawley
site visit**

Keep an eye on your inbox and sign up!!

THE SCIENCE OF WELLBEING

THIS TOUCHES A NERVE

BY FAITH MARSH



As you are all scientists (?! - Editor), I thought you'd like to hear more about research happening in the fields of positive psychology and neuroscience, and how this contributes to wellbeing. I've summarised papers to provide an introduction to some key ideas.

All brain activity depends on the neurons - cells that carry information from one place to another through a combination of electrical and chemical signals. Information is transferred between neurons at synapses, and is typically mediated by chemical signalling molecules, called neurotransmitters. For example, dopamine is a neurotransmitter which facilitates enjoyment of experiences and drives the desire to engage in activities.

The outer layer of the brain forms the cerebral cortex, which is responsible for many attributes that we consider inherently human, such as language, reasoning, and imagination. Below the cortex, in the centre of the brain, are the subcortical structures, containing the amygdala and parts of the prefrontal cortex. Neuroscientific evidence indicates that the subjective experience of happiness, pleasure, and general wellbeing depends on shared or overlapping networks of interacting subcortical and cortical regions. Disturbances in the structure and function of these regions can reduce the ability to experience positive emotions and pleasure; this is common with chronic stress, anxiety, and depression.

Wellbeing is determined by genetics, current circumstances, life

events and internal state of mind. In other words, we have some control of our wellbeing. Our thoughts can greatly influence our outlook on life.

Until recently, it was thought that our brains were hard-wired at birth; this is not the case. The brain is a dynamic system, which responds to environmental demands through actions; its anatomical structure and physiology continuously change throughout our life. This ability to physically change to adapt to circumstances is neuroplasticity. In other words, we have the power to change our brains for the better. We can "rewire" our brains to boost mood and overall wellbeing through different training and exercises. Mindfulness engages brain regions that are key for body awareness, memory, and emotion, leading to positive wellbeing. Physical exercise changes the way the brain processes the information, and has a positive effect on the structure and function of a number of brain regions.

If you would like to check how happy you are, check out [authentic-happiness.com](https://www.authentic-happiness.com). This test only takes a few minutes to fill out and gives a report with hints and tips to improve your score. For anyone who wants to learn more, I would recommend the Science of Wellbeing course by Yale, which you can do for free online, or any books written by Martin Seligman. If you want to discuss further, or read of the research I quoted in this article please get in touch.

FAITH MARSH is the departmental wellbeing adviser. Get in touch if you need advice or someone to talk to: f.marsh@imperial.ac.uk

UNCLE B

SMART, SASSY, AND WISE - YOUR GO-TO GUY

After being pleasantly surprised to actually get reader questions this year (**I tried** - Editor), I thought it only best to dedicate this edition of 'Ask Uncle B' to answering all of your fantastic/amazing/incredible (my thesaurus is running out of alternatives for "interesting") questions!

Q: Where are our hoodies?

A: Where you left 'em. Probably on the back of a chair, or in a wardrobe, or thrown on that floor you'll totally pick things up from at "some point soon". Oh...you mean the ChemEng ones? Try asking our Regalia Officer (I assume we have one of those, right?) (Editor - Yea, get in touch with Aris (aris.mornto17@imperial.ac.uk). (Deadline was 15th Nov. for orders... oops)

Q: How does one do Heat and Mass Transfer?

A: I note that a certain pessimistic reader commented "very unsuccessfully" after this question. I won't lie, H&MT can be tough. Like real tough, it certainly was for me and many others. However, it's only exponentially more so if you don't carefully review the lectures, perform some background reading on the subject or practise any of the problem sheets. There in hopefully lies the path to a potential solution and overall brighter future for you.

TL;DR: keep at it, U got dis.

Q: More coursework.

A: Is that a request or an exclamatory question? Otherwise, this is a statement and (unless no one else told me) I'm only paid to answer questions unfortunately. And I'm not even paid.

Q: Why am I always sleep-deprived?

A: Same. But seriously, check out: sleepimperial.com

Q: Who let the dogs out?

A: Somebody clearly unqualified to look after dogs smh...

Q: What is life?

A: 42.

Q: How to love life?

A: Focus on the positives, accept that life isn't always good or easy but acknowledge that no matter what it always gets better.

Alternatively, if you're asking about how to have a love life:

What is love? / Baby don't hurt me. / Don't hurt me. / No more.

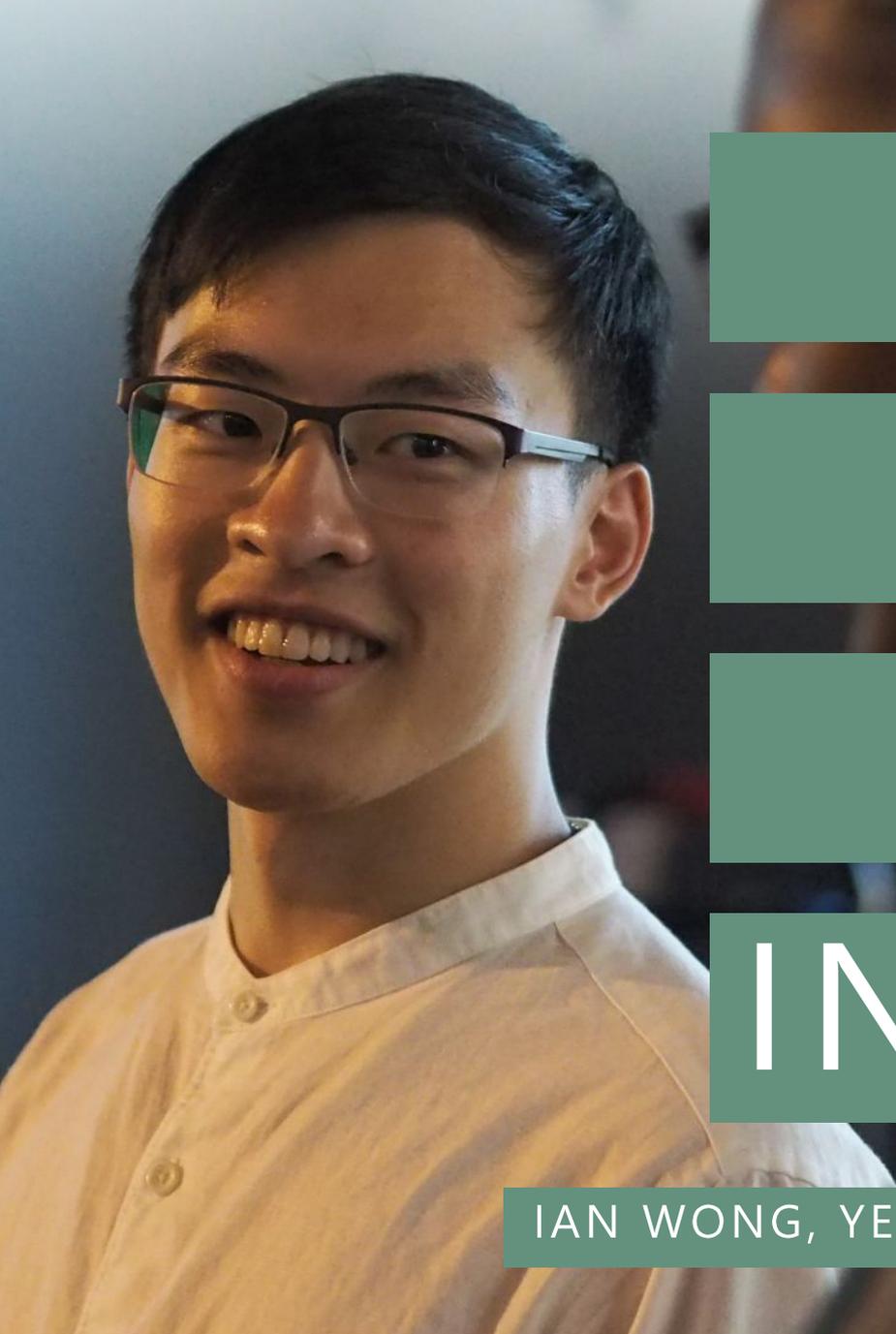
Q: How do you separate elementary particles?

A: Short answer, you can't. Longer answer, if you find out how to then the Nobel Prize would like to know your location.

ChemEng Love,

Uncle B xxx

Got a *****burning***** question for Uncle B? Write your questions on the board around the Department.



CHAT WITH AN INTERN

IAN WONG, YEAR 4 UNDERGRADUATE

BY KATHRYN JAITLY

BIO

Name: Ian Wong
Job: Product Engineer Support Intern
Company: OSIsoft
Humble Brags: Jiu Jitsu national champion, 2018

What is OSIsoft?

OSIsoft is a worldwide data infrastructure company that provides proprietary software to a variety of industries. Well-known companies such as BP, Shell, and AstraZeneca use this software in their day-to-day business.

This software, the OSIsoft PI system, transforms data gathered directly from the data source to a usable format for the client. High frequency real-time data from devices, such as pumps and sensors, are instantly accessible by any process engineer for monitoring purposes and also available for further analysis and output for visualization and dashboard purposes.

Essentially, the software provides end-to-end visibility across an entire enterprise, which is great

for business analysis, process efficiency, asset wealth and many more things.

Briefly describe your internship

My internship ran from mid-June till the end of August, (so lasted around two and a half months) and was based in the OSIsoft London Office.

The first 4 weeks or so was going through online tutorials, hands-on experience and sessions with my assigned mentor. The second half was the real work, where I handled multiple cases (often at the same time) from different customers who encountered technical difficulties in using the software. Here I diagnosed and troubleshooted their problems through emails and remote sessions.

What was your favourite aspect of the internship?

I was sent to the OSIsoft Frankfurt office (all expenses paid!), to take part in their customer course, where real customers attended to learn how to use the software alongside me. This was great since I got to meet a wide variety of people of different nationalities and from different types of industry sectors, and it was interesting to hear what the PI system does for them and their company.

What did you dislike about it?

There was a lot of information to take in at the start. It got easier rather quickly, but the initial shock of having to learn a completely new thing, and essentially needing to become proficient in the software in order to provide helpful support to customers, was a challenge. However, I was surrounded by a great team, who all had gone through the same thing and so lots of advice and tips were available to me.

What skills and experiences were most useful to you during the internship?

I think the good studying and time management skills picked up during my time at university helped tremendously. Having already been in an environment of learning and managing deadlines, going through and making notes thoroughly for myself to refer to definitely helped. Additionally, having been president of a society (Jiu Jitsu), and being familiar with drafting and writing professional-like emails, came in handy.

What is your career plan in the future?

Currently just keeping my options open. It's still early days and I'm steadily sending out graduate job applications. And in five years? I have absolutely no idea. Hopefully making bank.

Was the internship assessed?

The internship was not "assessed", but I had both a mid-internship and end-of-internship performance evaluation from my mentor and manager, as well as critique on my presentation from when I was in Frankfurt.

Where did you first hear about OSIsoft?

I first encountered OSIsoft at the Imperial Careers Fair last November. Here I met my future manager, Felicia, and spoke to her about the role and the company.

What made me speak to Felicia, and I suspect what makes many of us go up to find out more, was the fact that OSIsoft hires specifically chemical engineers. The founder of OSIsoft was a chemical engineer himself, and it's the knowledge of the sector and process systems that is invaluable to the company.

Why did you apply for the role?

I knew I didn't want to go into a role that's full-on engineering, but still wanted to make use of what I had learnt. I have always had an interest in technology and software so an internship to discover what OSIsoft is made sense.

Outline the application process

I actually didn't apply to OSIsoft until February/March 2019, when OSIsoft approached ChemEngSoc to carry out shortlisted interviews. I sent my CV and was invited to a series of three interviews, the first of which was a phone interview with HR. After this I was invited to a technical interview in our department with an actual Product Support Engineer. Finally, I was invited to an onsite interview, which was more about going through my CV and behavioural-type questions. All three were relatively straightforward. It's as much as about them finding out about you, as you are gauging whether you can see yourself as part of the company. Interviews are always two-way; always keep an open mind.

GOT MORE QUESTIONS? Get in touch with Ian via LinkedIn or email: iyw16@ic.ac.uk



CHAT WITH A GRAD

MARLENE KANGA (AM), CLASS OF 1977

BY HIREN PANDYA AND SARA WEST

BIO

Name: Marlene Kanga
Job: President, World Federation of Engineering Organisations (WFEO)
Humble Brags: Member of the Order of Australia; One of the Top 100 Engineers in Australia; etc. (Not enough space)

Dr Marlene Kanga, AM, is President of the World Federation of Engineering Organisations (WFEO), an international body representing some 100 engineering institutions and approximately 30M engineers around the world. She is the first chemical engineer to hold this position, specialising in process safety and risk engineering for the oil and gas industry in Australia and New Zealand.

What has been your career path since Imperial?

After graduation, I had a very successful career in process safety engineering in Australia and New Zealand. I drafted the first land use safety criteria to safeguard the community from the development of hazardous industry (i.e: industry that involves toxic, explosive or flammable chemicals). These were adopted into regulations

across Australia, New Zealand and Singapore; they have kept millions of people safe.

I was one of the first female members at Engineers Australia, gaining chartership and became a Fellow of the Institution. I didn't take an active role in the WFEO until 12 years ago. I helped to rejuvenate the national Women in Engineering Committee and became a founding member of the WFEO Women in Engineering Committee in 2008. This led to my election to the Board of Engineers Australia, serving as National President in 2013. I was elected to the WFEO Executive Council, becoming President in 2015 until present.

Why did you decide to become President of WFEO?

I never planned it! This was a natural progression of voluntary service in engineering; I love engineering and simply wanted to give back because it has given me so much. My objective has been to serve, to make a difference. It's not about me, it's about the outcomes.

What does your current role involve?

The WFEO is the peak body for engineering. It is the voice of engineering at an international level, promoting the important role of engineers in key global issues, such as sustainable development, growing urban populations and climate change. WFEO is recognised as a respected, reliable source of guidance for strategy and policy using engineering and technology to benefit of human development and sustainable outcomes.

As President, I am Chair of the Board and the General Assembly. I set and lead strategic objectives of the organisation through the Board, and ensure sound governance and administration of WFEO.

I also engage with the other international organisations such as the UN, UNESCO and the World Bank, as well as other technical bodies. This engagement enables us to work together to achieve our strategic objectives, especially to address the global shortage of engineers required by industry. We also work together to ensure that engineering education reflects current needs.

*

What was your initial impression of the Department?

I came to Imperial to specialise in process safety, as I wanted to work in a field of "socially responsible" engineering. I was aware of environmental issues and the course seemed very appropriate to my goals. I was impressed to find that about 10% of the students were women and many were international students*. I was also in awe of the impressive research credentials of Imperial staff. I was empowered to explore, to think about problems and develop solutions without constraints. The international student community was also a great network and many have remained lifelong friends.

When I became President of Engineers Australia and visited my peer institutions in Asia and the UK, many of the presidents came from Imperial College and had a Diploma of Imperial College (awarded to postgraduates at Imperial). It demonstrates that we go on to be leaders in varied fields around the world.

How did Imperial shape your career?

I was very fortunate that I specialised in a field aligned with socially responsible engineering. In Australia, I was one of the very few with formal process safety qualifications; I quickly built a career that took me around Australia and New Zealand visiting every chemical plant, refinery and gas processing facility, in the very remotest locations, even the outback! I am well known for my purple safety boots as one of the very few women in this field and I love every minute!

Why did you study Chemical Engineering?

I loved mathematics and science, especially chemistry, and I liked to know how things worked. I am a practical person and studying pure science seemed to lead to a laboratory research career. I couldn't see myself there.

What advice would you give chemical engineers at the start of their careers?

I would give the advice that was given to me by my manager in my first job in London, who happened to be a woman and an expert in furnace design. She encouraged me to get to know everything, refuse no task no matter how small and never lose my passion or interest in the job.



LYES

KAHOUADJI

RESEARCH ASSOCIATE, 2015 -

BY RAVI SHANKAR, SARA WEST, AND KAGISO BIKANE

Episode 6 of ChemEng Conversations brought us a fascinating journey into the world of virtual reality with Dr Lyes Kahouadji. Lyes has been a postdoctoral researcher in the Matar Fluids Group for several years now and his expertise lies in developing computational fluid dynamic (CFD) simulations of multiphase flows, primarily in the oil and gas industry. Recently, his research interests have expanded horizons and entered new dimensions, literally speaking! He, alongside his colleagues in the group of Professor Omar Matar, has been instrumental in developing a breakthrough virtual reality technology to

visualise complex 3-D fluid flows and allow the user to directly “interact” with the flow field, pressure, vortices and other fluid phenomena. He envisions that this technology will be a valuable learning tool for our undergraduate students in the Department and in the long term, bring about a paradigm shift in the application of virtual reality for educational purposes.

Lyes first joined the Department of Chemical Engineering at Imperial College London in 2015 as a postdoctoral researcher in the Matar Fluids Group. Prior to this, he completed his PhD in

numerical modelling of fluid flows at the Pierre et Marie Curie University in Paris, France. During his Master's degree, he received academic training in a wide range of subjects pertaining to general hydrodynamic instabilities and multiphase fluids flows. Owing to his positive nature, his zest for bringing everyone together for enjoyable social gatherings in the Department, and his kindness to all, Lyes has become one of the most liked and valued member of Imperial ChemEng!

It was a pleasure to have such an interesting conversation with him on the show and find out more about his passion for fluid dynamics, virtual reality and his views on education styles.



Could you tell us about your research interests?

Sure – my research interests are focused in the field of computational fluid dynamics, specializing in multiphase fluids flows. We simulate multiphase flows (e.g. bubbly flows) where we have an interface between two fluid media, for example between liquid/gas or liquid/liquid. Common examples of these in day-to-day life are droplet formation between air/water interfaces or oil/water emulsions. Multiphase flows are common in the oil and gas industry. If you imagine in a typical industrial pipeline, you would have all three phases present simultaneously with the mixing of oil, gas, water and sand - this naturally presents numerous challenges to plant operation.

Our research into the simulations of such flows enable engineers and scientists to gain fundamental insight into the fluid behaviour and develop plant unit operation designs accordingly.

How did you become interested in this area of fluid dynamics?

Oh, that's a long story so I'll give you the short version! Well, I studied at the University of Paris and in the beginning, I initially wanted to study mathematics. However, I had an equal passion for both maths and physics, so I took a range of courses in each subject. I then came to the end of my second year and I had to make a choice for my career path. I was particularly intrigued about

this elective course on the aerodynamics of wings and how modern flights fly. I took this course and, although I'm not working in aerodynamics now, it spurred my curiosity about the role and behaviour of fluids in nature. Little by little by research interests started to take shape and my Master's degree introduced me to the world of numerical modelling of fluid flows, which continues to be the integral part of work today.

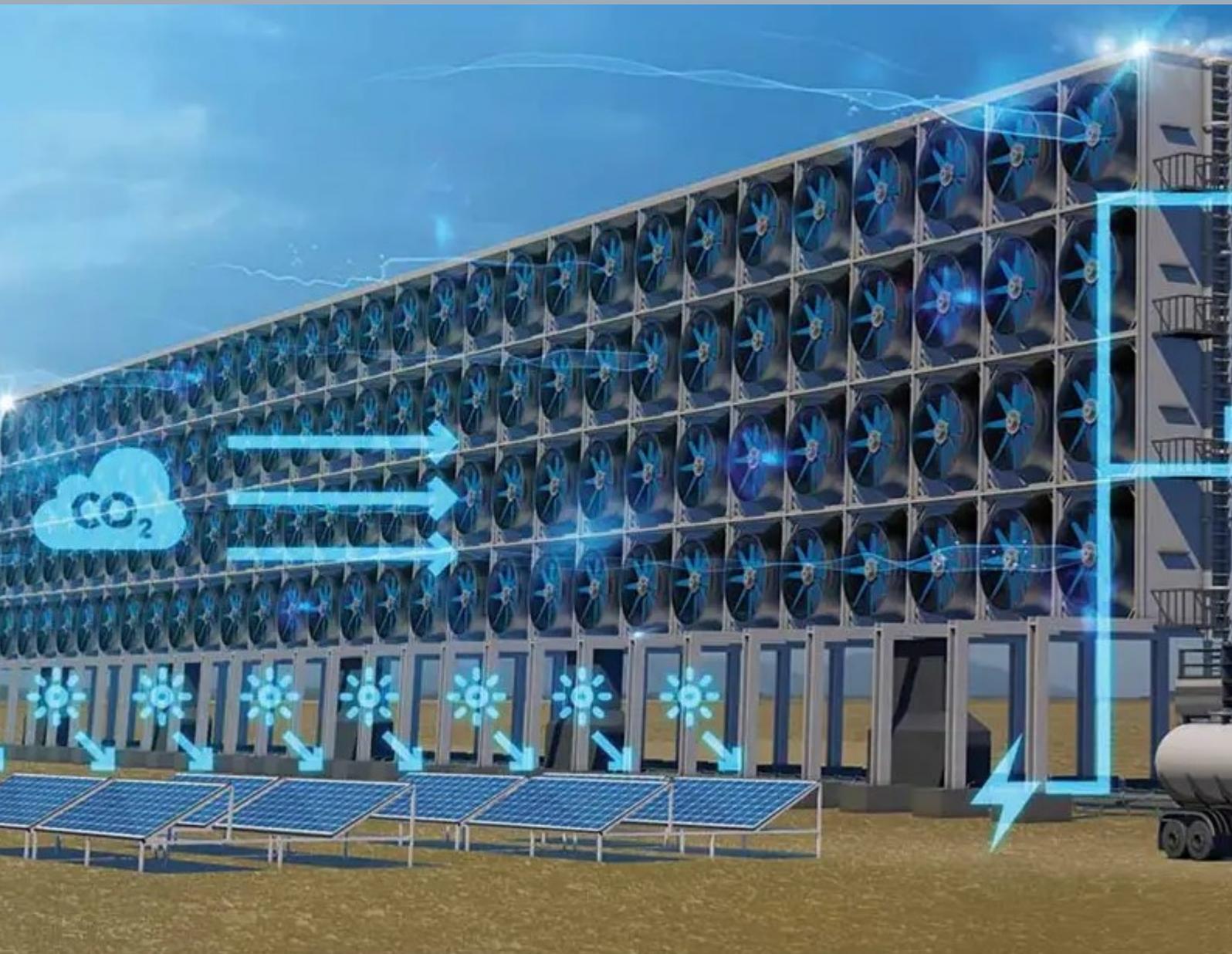
You've been instrumental in developing virtual reality flow software – the first of its kind to be used for education. What do you think are the next steps for this tech?

I think we first need to promote this software further – I think that there are a lot more avenues to explore, both with educational and research applications. For example, researchers wishing to visualize a flow are quite comfortable going to their computers and using the standard CFD or direct numerical simulation approach. If we can introduce a paradigm shift and make virtual reality the new norm, it could introduce a new way that we share knowledge of fluid dynamics. One could simply use the technology to “dive” into the flow so to speak and understand how key parameters such as pressure, velocity and vorticity evolve with time and space. What would be revolutionary is if a group of researchers interested in analyzing fluid flows could all connect and dive into the virtual reality together through the Oculus Rift (apparatus used for virtual reality) – it would literally be like entering the Matrix!

A colleague of mine is currently collaborating with Professor Erich Muller in our Department on applying this VR technology to visualize molecular dynamics on the atomistic scale, so there is interest in the technology. Without a doubt I think that everyone in the Department should have the opportunity to get hands on and try out this software themselves to truly appreciate its capabilities. I hope that eventually we can make VR the go-to tool for certain educational applications in the same way that other software such as MATLAB have established themselves.

WATCH THE FULL EPISODE:

www.youtube.com/playlist?list=PLDRmh8UgJCx_pUFROIcHYEbywb0o0iJ



BY DAVID HONE, SENIOR CLIMATE CHANGE ADVISER FOR SHELL

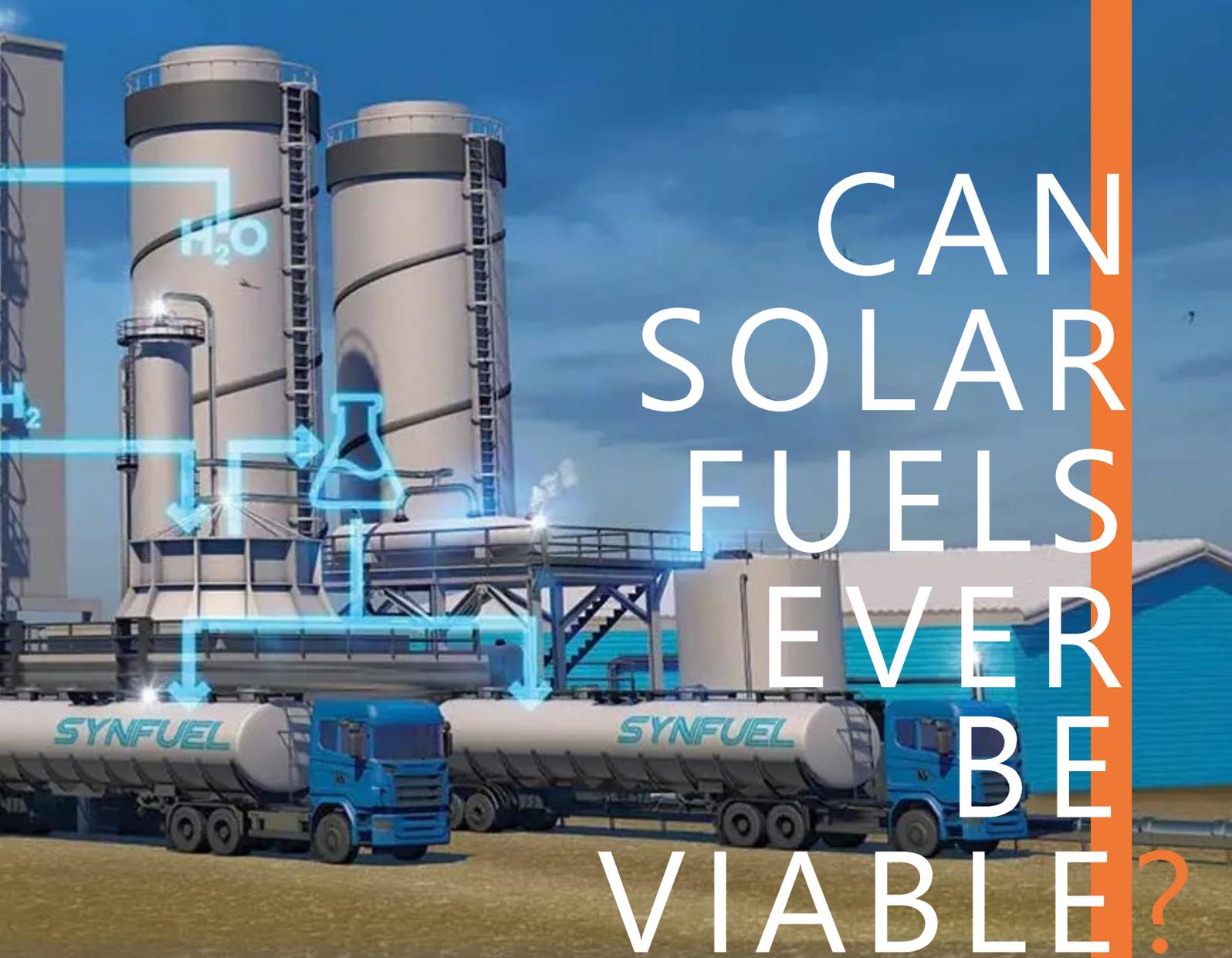


DAVID HONE IS SENIOR CLIMATE CHANGE ADVISER FOR SHELL. THIS ARTICLE FIRST APPEARED ON HIS BLOG.

THE VIEWS EXPRESSED IN THIS ARTICLE AND RELATED PUBLICATIONS ARE HIS AND DO NOT NECESSARILY REFLECT THOSE OF SHELL.

The idea of producing fuels from air, water and the sun has great appeal and the chemistry and technology to do so exists. Electrolysis of water to make hydrogen and air capture of CO_2 are both done today, albeit on a relatively small scale (compared to other ways of making hydrogen) in the case of hydrogen and very small scale in the case of air capture. Hydrogen and carbon dioxide can then be combined in different ways to produce fuels:

- The Sabatier reaction takes place at elevated temperatures (optimally $300\text{--}400^\circ\text{C}$) and pressures in the presence of a nickel catalyst to produce methane and water. **Synthetic methane** can substitute for natural gas.
- Using a palladium and copper catalyst the production of **methanol** is possible, which can be used as a liquid fuel or can be a building block for other fuels or petrochemicals.
- Activation of the carbon dioxide to carbon monoxide (e.g. using hydrogen, but CO_2 electrolysis is also a possibility), then combining this with more hydrogen (as



CAN SOLAR FUELS EVER BE VIABLE?

synthesis gas) to synthesize **hydrocarbon liquids** for use as fuels using the Fischer-Tropsch process (this process exists at large scale in Qatar and South Africa).

As an end-to-end process the above doesn't exist, other than at pilot plant scale. All the technologies have been proven, but building a facility that at least matches the scale of the Shell Gas-to-Liquids synthesis plant in Qatar is likely many years away. For example, the largest air capture facility in the world announced so far is a 500,000 tons per year facility due to start up in 2023. This is the equivalent of 136,000 tons of carbon or some 160,000 tons of Jet A-1, but the facility in Qatar produces ~8 million tonnes per year.

The reason for wanting to synthesize hydrocarbons from air and water is threefold:

- To mitigate the need for fossil-sourced hydrocarbon fuels, but continuing to offer the convenient energy dense carrier they represent;
- To meet the needs of activities that depend on hydrocarbon fuels, but cannot find alternative options. For example, aviation depends on Jet A-1 and while there is talk of some electrification of short haul flights and the long term possibility of fuels like hydrogen, there is no line-of-sight to a viable alternative. We should expect at least some planes to still be using Jet A-1 at the

end of this century even if a comprehensive viable alternative does eventually emerge.

- **To avoid using synthetic fuels derived from biomass**, which is technically easier and more cost effective but may face social issues relating to the use of biomass (e.g. the food vs. fuel debate).

We might also imagine building a very large scale synthetic hydrocarbon industry to meet all sorts of requirements, thereby taking the pressure away from the need to find solutions for all the current uses of fossil fuels, so effectively lowering the bar of difficulty from just aviation to many other sectors and uses. But to do this, the manufacture of synthetic hydrocarbons needs to be competitive with alternatives, even allowing for policy instruments such as robust carbon pricing.

A recent paper on synthetic fuels tackles the cost issue head on and looks at what we need to believe for so-called 'solar fuels' to become a reality. The paper focuses on the five principal elements required to manufacture solar fuels; solar PV, electrolysis to produce hydrogen, direct air capture of CO₂, hydrogen activation of CO₂ to CO and Fischer-Tropsch synthesis. Based on current costs of this array of technologies, the end-to-end cost of product from this process approaches \$900 per barrel, or around \$5 per litre. (This is broken down in Figure 1.) Much of this cost sits with the newer technologies, namely solar PV, hydrogen electrolysis and direct air capture. But these are also the areas where sharp cost reductions are either being seen or are anticipated:

- There is certainly abundant evidence that solar PV costs are falling, so a shift from \$50 /MWh to \$15/MWh is plausible. This alone equates to \$60 per barrel.
- There have been several recent articles outlining potential pathways for big cost reductions for direct air capture.

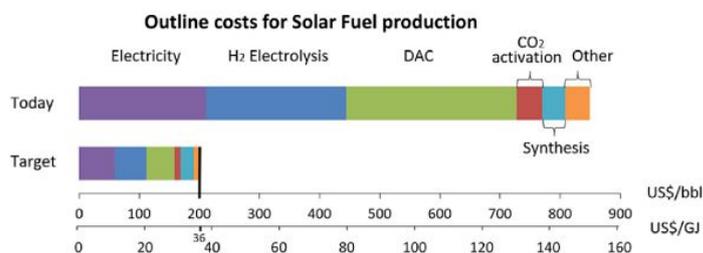


Figure 1: Outline costs for Solar Fuel Production

- In its recent report on the future of hydrogen, the IEA examined the rapidly falling cost of electrolysis.

In addition, significant relative cost reductions (i.e. 50-70% cost improvement) are also required in already mature technologies, such as Fischer-Tropsch synthesis.

The five technologies required are also at very different stages in their respective development. For example, although electrolysis remains quite expensive, it is far ahead in terms of commercial deployment when compared to Direct Air Capture. The latter is still in the early pilot phases of development, but is nevertheless making progress.

With all these factors aligning and imagining a policy regime which injected a carbon price into the mix (to bridge the final gap), it is just feasible to see synthetic fuels becoming an option. However, commercial considerations will doubtless prevail. For example, if direct air capture costs fall dramatically, it could well make more sense to continue using legacy infrastructure (refining crude oil) to make Jet A-1 and then capturing and storing carbon dioxide to balance the emissions. Such a route forward would also be one that supplied numerous other products where alternatives remain elusive.



SHELL HAVE GRADUATE ROLES AND INTERNSHIPS ON OFFER. DEADLINES:
GRADUATE ROLES: 20/12/2019
SUMMER INTERNSHIPS (TECHNICAL AND COMMERCIAL): 20/01/2020

Big project? Bigger failure

IPA Global claims that **over 60% of megaprojects 'fail'**. Failure is considered as exceeding project scale or CAPEX by 25%, or an inability to achieve steady state operation within a month of start-up. Failure still happens, even with Shell's introduction of the '**flawless execution**' concept over a decade ago. However, the steps to achieve flawless start-up may be simple in nature but not always simple to achieve.

Read more: NOVEMBER 2019 | The Chemical Engineer | page 48

Quantum supremacy?

Tech giants including Google and IBM are all battling it out to build the **first useful quantum computer**. According to a researcher in the field, hype is massive but **progress is slow**. Microsoft's research route relies on quasiparticles which is a form of matter which hasn't even been witnessed yet. It may take **decades** until quantum computers perform useful calculations, such as exactly modelling chemical reactions or interactions, or being able to screen large numbers of molecules to find promising pharmaceutical drugs more quickly.

Read more: New Scientist | 2 November 2019

Fukushima execs let off

Following one of the world's most devastating industrial disasters, former Tokyo Electric Power executives have been **cleared** of responsibility after a judge ruled that they 'could not have foreseen the earthquake and tsunami'.

Read more: NOVEMBER 2019 | The Chemical Engineer | page 11

UK Renewable Record

During Q3 this year, **more than half of the UK's electricity generation came from renewable sources**. With rapid growth in renewable capacity and falling electricity demands, this may become a common occurrence.

Read more: is.gd/d3Qgk3

Drug pollution crackdown.

With rising populations, the demand for medical drugs is at an all-time high. Drugs exhibiting chemical and/or metabolic stability can end up in wastewater systems after excretion from the body, where they can **affect wildlife** and contribute to **microbial resistance**. NOURYON and Van Remmen UV Technology have designed a process to remove **up to 90%** of these pharmaceutical residues. H_2O_2 is injected into the wastewater flow, and exposed to UV light to create OH. radicals. These radicals can destroy residues within **milliseconds**.

Read more: is.gd/svrs42

Chevron emission penalties

The Gorgon LNG project is facing penalties for **failing to meet environmental targets**. The project was required to capture and store at least 80% of reservoir CO_2 , but implementation of CO_2 injection system was delayed due to **technical issues**. The site became operational in August 2019. The severity of penalties is yet to be decided.

Read more: is.gd/GCQZPo

PUZZLES

TOTALLY NOT A RIP-OFF OF FELIX

CROSSWORD

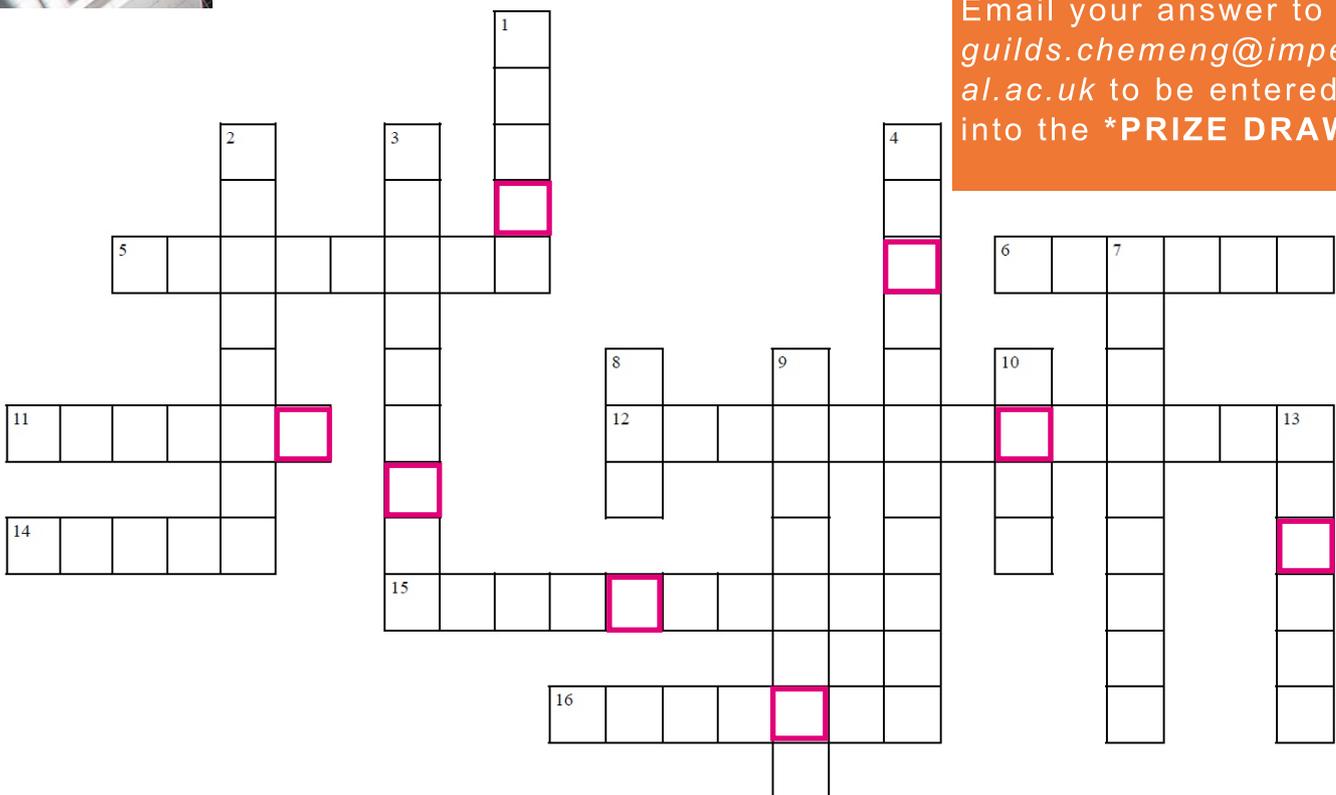
THEME: CHRISTMAS

Solve the crossword to find the letters in the highlighted squares. These letters can be rearranged to find another festive word.

FOUND THE ANSWER?

You could win some ***ChemEng Swag***.

Email your answer to guilds.chemeng@imperial.ac.uk to be entered into the ***PRIZE DRAW***.



ACROSS

5. Pig wrappings [8]
6. Glittering décor [6]
11. Hot spiced wine [6]
12. The Christmas Wham sang about in 1984 [13]
14. Seven of these go swimming [5]
15. A Christmas ballet [3,7]
16. The tightest squeeze on Santa's route [7]

DOWN

1. Santa's little helpers [5]
2. Pulled at Christmas [8]
3. Keeps colour throughout the year [9]
4. She wants you for Christmas [6,5]
7. Where Santa lives [9]
8. Will Ferrell's Christmas [3]
9. Contains presents by the fireplace [8]
10. If you're on this list, you'll get presents [4]
13. Winter ride [6]

WORDSEARCH

THEME: CHRISTMAS (IK, IT'S TOO EARLY.)

I C E C A L P E R I F C I M O R W F W G F R T
E H W E E S E E N F S G A Z K R E G O O R C S
Z E J L C L G L A D U N D N T U R K E Y U O S
F S N F E L I G M R G R Y M D Y D Y I I H V X
C T K U E E N N W Q A X U I H Y E L W I D M R
R N B Y T B G I O A R B L N O W C L I T E U Z
A U Z C S C E J N D P R E C M S V A J U O L S
N T N M A U R S S G L U L E E N T U N C T L T
B S O W N Y B A K O U D O P A O I T V E E E U
E B M R T R R S C K M O G I L W N C M R L D F
R U A E A D E R X K B L K E O W S A C Y T W F
R G N A X Y A C H F E F G S N A E E J T S I I
Y U N T I L D A S Y Q R D P E S L V O F I N N
M G I H W P O L A R E X P R E S S O E R M E G
B H C N C N C Z M T H G I N T N E L I S K V N

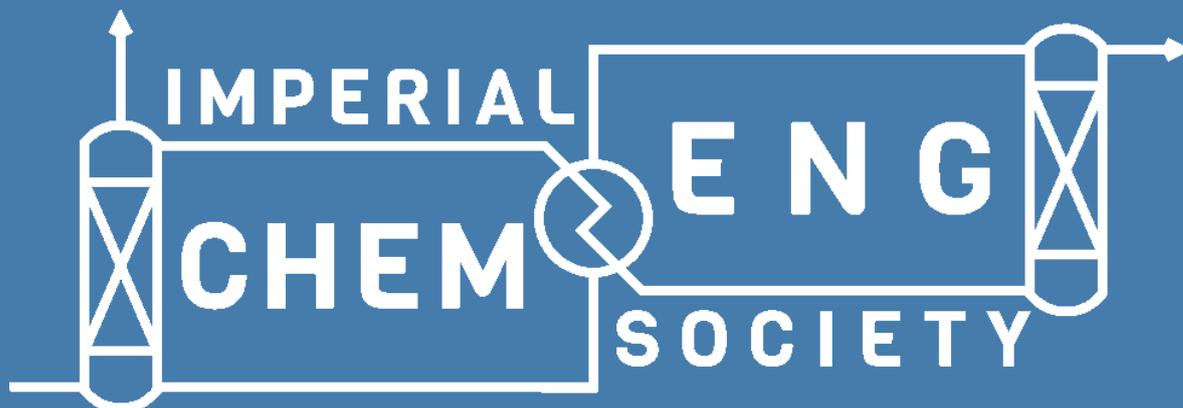
Words are hidden in the following directions: 

WORDS TO FIND:

BELLS	LOVEACTUALLY	SNOW
CANDYCANE	MINCEPIES	SNOWMAN
CHESTNUTS	MISTLETOE	STUFFING
CINNAMON	MULLEDWINE	SUGARPLUM
CRANBERRY	NUTCRACKER	TINSEL
ELF	POLAREXPRESS	TURKEY
FIREPLACE	RUDOLF	WREATH
GINGERBREAD	SANTA	YULELOG
HOMEALONE	SCROOGE	
JINGLE	SILENTNIGHT	

COMPLETED THE WORDSEARCH?

Congrats. Well done. Now... back to the degree.



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