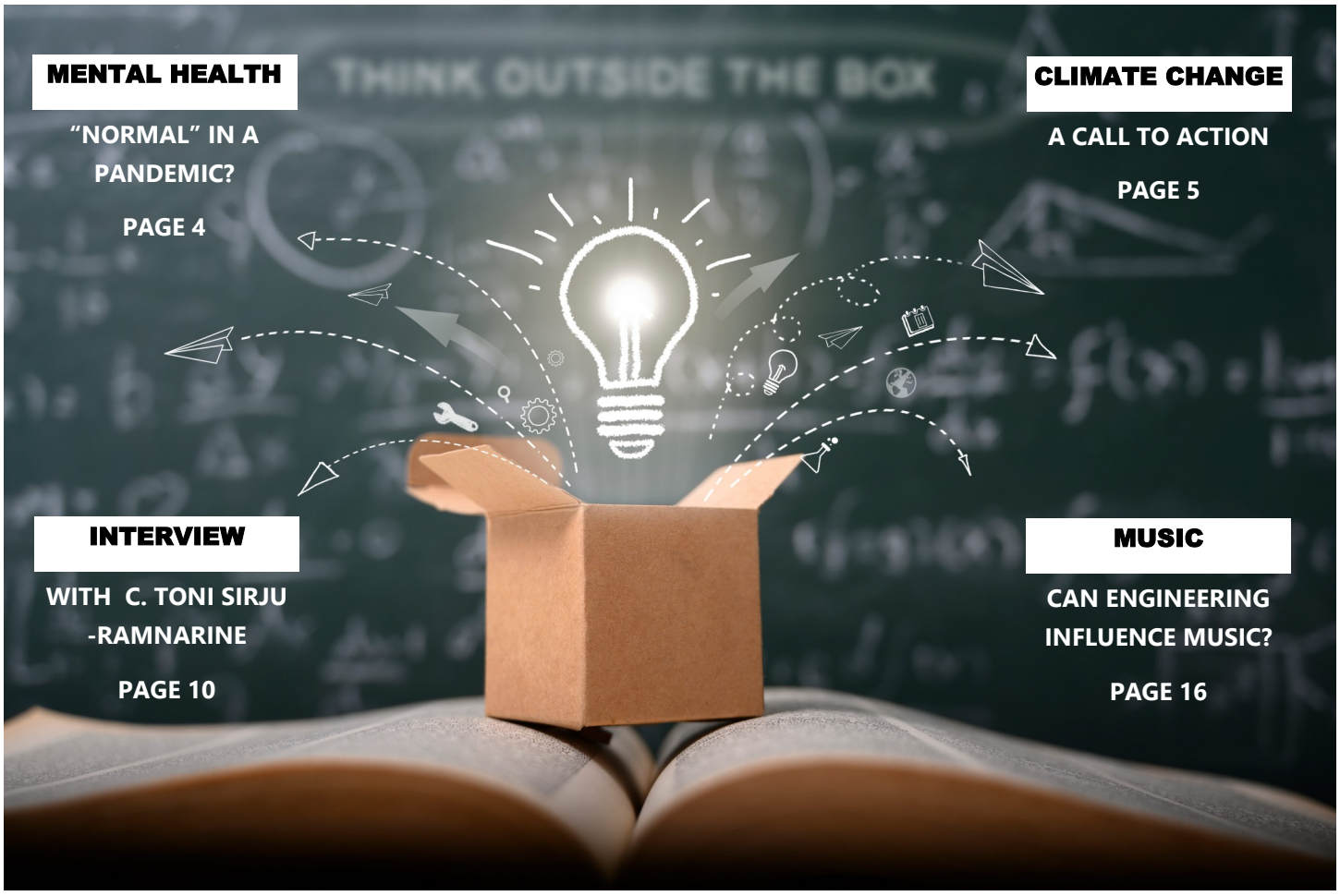
IChemE

Trinidad and Tobago
Members Group

THE VESSEL

NOVEMBER 2020

CREATING A BETTER TOMORROW



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INSIDE THIS ISSUE

SAFETY MOMENT

COVID-19 spreads primarily from person to person. Fighting this disease is our joint responsibility. Protect yourself and others by making these 6 simple precautions your new habits:

- Clean your hands often.
- Cough or sneeze in the crook of your elbow — not your hands!
- Avoid touching your eyes, nose and mouth.
- Limit social gatherings and time spent in crowded places.
- Avoid close contact with someone who is sick.
- Clean and disinfect frequently touched objects and surfaces.

Source: https://www.who.int/westernpacific/emergencies/covid-19/information/transmission-protective-measures

MESSAGE FROM OUR CHAIR

We at IChemE TTMG would like to take this opportunity to extend empathy and in some cases, condolences, to the many affected by the COVID-19 pandemic.

As we cope with the bad, we reflect on the many lessons 2020 has taught us—or rather, continues to teach us. Yes, the year that promises to keep on giving!

Collectively, we need to continue thinking outside of the box, planning for the rainy day, starting that entrepreneurial venture, partnering with like-minded persons to form pro-bono consultancies and harnessing our thoughts and ideas into action.

Comrades, 2020 is reminding us that as much as we feel forever young and sometimes invincible, we do have finite lives and before we know it, what will remain is our legacy for those that we leave behind – our children, our heirs and loved ones. Let us live purposefully and intentionally, not just in our personal lives, but also in our professional ones.

At IChemE TTMG, we have had a full 2-year slate with the current Management/Steering Committees, not without some challenges. Notwithstanding, there are several opportunities for us to transform. As we head towards our Annual General Meeting and upcoming internal elections, it is our wish that even greater support is provided to the Member Group from you, the local chapter, allowing us to find innovative and creative ways to better serve those in our discipline. We hope to see persons stepping forward to take the mantle of leadership within our sub-committees and volunteering their time and intellectual know-how.

As much as we had planned for an interactive year of face-to-face engagements, 2020 turned out to be our Debut Year of the Webinar, for which we were excited to see such a great turn out. Due to the uncertainty that is COVID-19, we will continue to operate in this manner into 2021 but hope there may still be some opportunity to reconnect in the physical space in the not-too-distant future.

Having served in this capacity as Management Chair for the last 2 years, it has certainly been a learning experience and I thank the hard working team on the Management Committee for their donated hours and their commitment in planning the events that were brought to you. The Steering Committee also has an integral role in providing direction to the Group and moving forward, we encourage persons to experience the excitement and fulfillment of volunteerism through the various positions available. With a fully committed team, one that is flexible and understanding, you will find the experience to be one that is achievable and certainly gratifying.

With this, I want to again thank our membership for their devotedness and look forward to your active participation in the planning and execution of the missions before us for the period 2020-2022.

Do enjoy this second and last ***The Vessel*** issue for 2020!

Monifa Graham
IChemE TTMG Management Committee Chairperson

WHAT IS "NORMAL" IN A PANDEMIC?

Author: Dr. Sarah Chin Yuen Kee, Clinical Psychologist

We've been inundated with this COVID-19 pandemic for months now. Meanwhile, little shifts in the quality of our daily life occur, whether we voraciously devour or deliberately ignore the news.

For those of us who still have our jobs, the initial gratitude may have worn off as we struggle under the strain of navigating rosters, working at home, or having to be away from family. Never mind those of us supporting children who must now discover levels of discipline never before imagined for online classes.

As a psychotherapist, Zoom has become the new 'frenemy' and my personal living space where I unwind, is now my work space too. With no commute, there is no obvious boundary between my work and rest. Furthermore, everyone keeps talking about a "new normal" but nothing feels normal, we're miserable, and no, the masks still don't feel comfortable.

Feeling irritable, restless, or numb? Feeling oddly unmotivated to do much of anything? Maybe your appetite or sleep patterns are erratic. Perhaps your concentration is poor. You may be normal. It is really important to remember that the situation you are facing is extraordinary and that your stress response is a healthy one.

So how do we take care of ourselves when it remains a challenge to have a meal with friends or play football? *Physical* distancing for wellbeing has tragically resulted in *social* distancing for many who are now feeling lonelier and increasingly isolated. Chatting over Zoom is just not the same.

Uncertainty is one of the biggest stressors for us controlling humans and this pandemic triggers uncertainty and powerlessness in spades. Adaptation is a process, particularly as the situation remains fluid; while a vaccine may be on the way, we are not out of the woods yet. The initial panic that we felt in March has given way to a wave of depressed moods for many of us. That feverish rush to secure Lysol and hand sanitiser has been replaced by a level of fed-upness (yes, that's a word!) as we struggle to keep up our efforts for the foreseeable future.

First, go easy with yourself and those around you. We're all struggling and patience can run thin. Perfectionists – go ahead and lower the bar; it is unrealistic to think you can manage it all under these circumstances.

Second, add variety. Whether you're learning a language on Duolingo or googling recipes now that the doubles vendors are out again, try something different. Follow a guided meditation or read what all the fuss is about Mindfulness.

If you're on your screen for the day, don't rely too heavily on Netflix for relaxation. *Put down the device.* Give your eyes a rest; find ways to exercise around the house or browse YouTube fitness channels. Take a drive to a corner of Trinidad you've not been to for ages; and books are not just for the bathroom; try reading a paperback. If concentration is poor, steal one of your kid's Harry Potter novels.

While there is anxiety about contracting the virus and, worse, bringing it home for others, consider how you might socialise responsibly. Re-consider declining that Zoom coffee, because you must be kind to yourself and stay connected as best you can with those you love.

Life is about doing your best within the spaces you find yourself.

A CALL TO ACTION FOR MANAGING CLIMATE CHANGE

Author: Varuna Maharaj, MSc. Integrated Environmental Studies

Before the world was thrown into the most significant health pandemic of this modern era, there was and continues to be a more catastrophic challenge on the horizon - climate change. The consequences and global impacts of climate change continue to show their effects. Evidence also points to these effects becoming more severe in time, if a united global response is not effectively actioned to mitigate the impact of rising global temperatures.

Climate change is not new to our planet and has happened throughout history. The dilemma today is that the rate at which things are changing due to human dynamics is increasing. The majority of the warmest years on record have all occurred in the 2000's. Current impacts such as rising sea levels and higher temperatures are leading to changing ecosystems and the displacement of people. Coral reefs worldwide, inclusive of our Caribbean reefs, are also being affected as coral is very sensitive to temperature changes. Coastal erosion is also more apparent and exacerbated by more intense, frequent storms and flooding events. Bee population sizes have also reduced, thereby impacting biodiversity and agriculture.

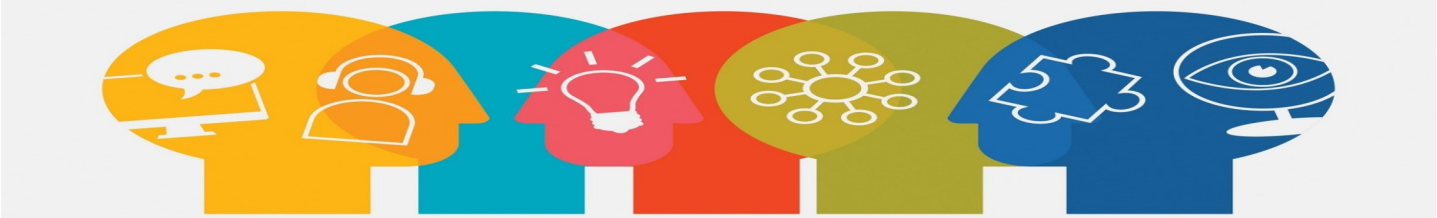
The Paris Agreement in 2015 was groundbreaking as nations united with a quantitative pact based on the science and acknowledged 'We are all in this together'. Its main objective is to align the global climate change response to keep the overall temperature rise for this century less than 2°C above pre-industrial levels and further limit the temperature increase to 1.5°C with continued mitigations. Those countries expected to be most impacted are also to receive support from other nations. Regionally, Caribbean nations have also ratified the Paris Agreement. The region has not been left unscathed, as evident by the greater intensity of recent hurricanes (e.g. Hurricane Maria, 2017) and changes in rainfall patterns which affect the region's water supply and increase the frequency of flooding and bushfires.

A Call to Action has been sounded as many believe that the Covid-19 global pandemic is a mere dress rehearsal for what is to come for the later generations. More action will be needed to combat reduced water and food supplies, more intense natural disasters, coastal erosion, loss of biodiversity and changing ecosystems.

The global population is answering this need for change with adaptations for cleaner energy and technologies, waste reduction initiatives, increased awareness – especially for the younger generations – and demanding more from political leaders to change/create policies and legislation to enforce better habits.

Although Trinidad and Tobago is not a significant contributor to overall global greenhouse gas emissions, we are still ranked second highest per capita for greenhouse gas emissions and as such; steps are being taken to reduce GHG emissions. These include plans for solar plants, hydrogen power development and governmental incentives in the form of tax breaks for solar water heaters and using CNG.

Collectively, we all need to become environmentally responsible global citizens who consider the future generations and ask ourselves, "how we can influence and drive change to help spare these future generations of these enormous burdens.



A LEARNED SOCIETY AND ITS ROLE IN DIVERSIFICATION OF THE ECONOMY

Panellists: Ronald Adams, Colin Bain, Christopher Farquhar, Maurice Massiah, Dr. Marian Watson.

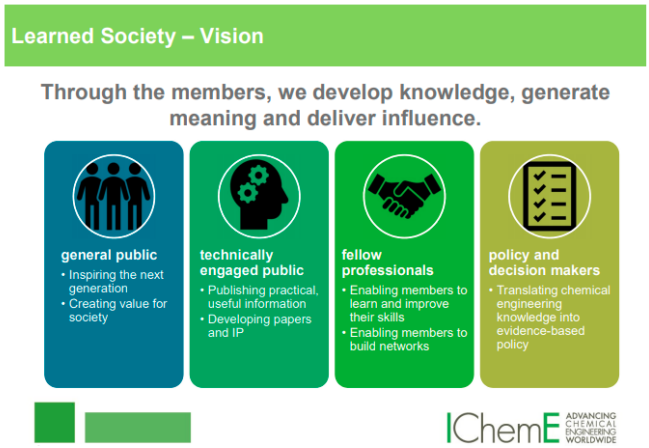
Moderators: Monifa Graham, Shannon Pustam.

Date: 4th September 2020

This panel discussion was one of the first of its kind and met its intended purpose of stimulating discussion on several important topics impacting our society, including understanding the Role of a Learned Society, Economic Diversification and the Chemical Engineer, COVID-19, Alternative Energy, Food and Water Supply Management, Entrepreneurship and Innovation, Job Creation Advice for Young Engineers and the Versatility of the Chemical Engineer. This webinar featured industry executives such as Mr. Ronald Adams, Upstream General Manager of Shell Trinidad and Tobago Limited, Mr. Colin Bain, Managing Director of Methanex and Mr. Maurice Massiah, Engineering Manager of Massy Wood, as well as experts in the fields of Process Engineering Consultancy and Education – Mr. Christopher Farquhar and Dr. Marian Watson of UTT respectively.

The IChemE concept of the Learned Society defines a system where there is dialogue between discipline engineers (Chemical Engineers amongst themselves, as well as with other disciplines) and between these engineers and society. The goals of the Learned Society concept are depicted in the 'Learned Society Vision' figure below.

IChemE TTMG has taken up the task of demonstrating the linkages between establishing a Learned (and continuously learning) Society and Diversification. In summary we believe that it is through entrepreneurship and innovation, and the value these create for society, that the economy can be effectively diversified. Furthermore, with the field of Chemical Engineering being much broader than its initial reputation of producing only oil and gas professionals, it is through the acknowledgement of all the dimensions of this broad



field and the talents of the Chemical Engineer that true diversity can be bred. Not only were the technical skillsets of Chemical Engineers discussed, but also the behaviours and changed mindsets which can catalyse evolution in our own day-to-day operations as well as our relationship with society.

Below we briefly touch on some of the main aspects which were shared during the 'A Learned Society and its Role in Diversification of the Economy' Webinar and hope that it stimulates further thought to our readers.

Chemical Engineers and Implementing the Learned Society Vision

Chemical Engineers can contribute to the Learned Society vision of energizing the next generation by giving back to society through volunteerism. This can be done via providing career talks at alma maters, thereby assisting with mentorship and career guidance. Another area for consideration is adopting an active role in government assistance through lending our technical expertise. For instance, there are a number of government 'whitepapers' that are published and it is common for qualified professionals to be sought out to review them. One such document, the "Roadmap to

Recovery", presents a number of elements for recovering from the impacts of the COVID-19 pandemic. It should be noted however that this document is only a roadmap—"What we need to do is really build that vehicle and fuel it in order for us to get to our destination.", a steer provided by Mr. Maurice Massiah.

Food and Water Security

Although time was not spent addressing this particular question during the webinar, the matter of Trinidad and Tobago's import/export balance is of importance, as the COVID-19 pandemic highlighted the vulnerabilities of all global logistics. The Trinidad and Tobago import bill is quite substantial, whereby in 2019 alone, close to TT $6 billion was spent in food imports. Chemical/Process engineers can apply their technical knowledge to aid in farmers' activities, thereby impacting food security. We can assist farmers by utilizing principles learnt in our various degrees to turn waste materials into fertilizers, clean up water ways, reduce pollution and clean the environment. It was also suggested that we can also contribute to the local food and beverage manufacturing industry, as discussed in a 2019 IChemE TTMG technical talk – "The Hidden Role of Chemical Engineering in the Food Industry" with Ms. Jamillah David.

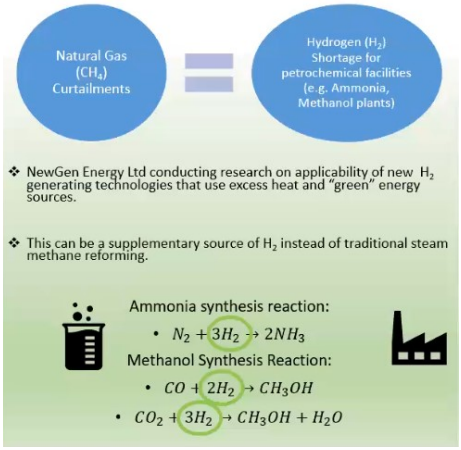
In terms of regional/international perspectives, the Economic Commission for Latin America and the Caribbean points to the agro-processing sector for unlocking exciting opportunities for economic diversification in Trinidad and Tobago, whereas the Oxford Business Group points to the manufacturing sector as a key potential driver for T&T's economy.

Regardless, whether it be technical support directly toward agriculture, or quality assurance and process optimization in food manufacturing, the Food Sector is indeed a space where the Chemical Engineer can lead and guide the several processes involved.

Water security is also a pertinent issue relevant to the Trinidad and Tobago societal context. Panellist Mr. Christopher Farquhar alluded to the loss of almost 50% of domestic water supply being attributed to leaks, suggesting that engineers can have an impact here by applying the necessary technical skills to aid in reducing this loss to a more reasonable statistic such as below 25%. He highlighted the need for strategic water distribution and adequate planning for water supply to new housing developments. Mr. Farquhar also identified opportunities for engineers to play a role in the protection and development of new catchment areas. He noted that, as a Learned Society, policy must be informed by our understanding of our problems and the impact of our actions. He believes that if we were to bear some of the cost of producing water, it would lead to behavioural change and more responsible usage, similar to, in some cases, persons switching off appliances and or lights to manage electricity costs.

Alternative Energy

Due to Trinidad and Tobago's tropical climate, solar energy is perhaps the most viable source of alternative energy. Quite inspiringly, several other Caribbean islands have already incorporated solar energy as a source of electrical power, including Barbados and Guyana. During this webinar, it was noted that the skills possessed by our local engineers are transferrable for implementation of solar panels and incorporation of electrical power into the grid.



Additionally, we as a nation can become excited about the prospects of new projects being embarked on by Lightsource bp, Shell Trinidad and Tobago Limited and the Government of the Republic of Trinidad and Tobago.

Currently, however the use of solar energy is sparse due to lack of incentive to transition away from traditional sources of energy. Change in government legislation is one way to accelerate the move to alternative energy and it is recommended that supportive policy framework be instituted to motivate Trinidad and Tobago's transition to green energy-such as the Feed-in Tariff policy which is being developed. Herein lies another opportunity for our own professionals to have a voice and contribute to government policy, in line with the Learned Society vision.

Finally, the webinar provided some discussion around there being the potential for green energy synergies within the

A LEARNED SOCIETY AND ITS ROLE IN DIVERSIFICATION OF THE ECONOMY CONT'D

Point Lisas Industrial Estate. To enable this, feasibility studies are necessary to maximise these opportunities as it may be applied differently for specific companies (such as those of upstream and downstream, as well as steel manufacture and power plants, to name a few). An example of this is the study being conducted by NewGen to assess the feasibility of hydrogen production from electrolysis powered by waste heat from Powergen. Several industry operators have already started incorporating green technologies within their operation to become more sustainable. Although green technologies are currently available, they are costly to institute, therefore reducing their commercial viability.

However, with advancement in research and development, these technologies would become more cost effective and applicable in time. This poses an interesting challenge for Chemical Engineering university students to help unlock and research in this area should be encouraged.

Versatility of the Chemical Engineer


How do we break the status quo?

Chemical engineers, and engineers on the whole, are not limited to technical fields. In fact, engineers' analytical nature is a transferrable skill that can thrive in other sectors, such as Finance. In fact, it was highlighted that the current Minister of Finance is a Civil engineer. Other pursuits that our local engineers have been thriving in include being general managers and CEOs of companies. In this webinar, the panel reminded the listeners that there are no boundaries to what we, as engineers ,can do.

This is where the power of mindset comes in – not only that of us engineers, but of those around us. An example was provided of the recent works of an engineer who noticed irrigation issues that farmers were having, and decided to post a video on YouTube which defined the problem and outlined possible solutions. This video gained the attention of a government Minister, and the engineer subsequently had a meeting with the Permanent Secretary and other high-ranking persons in office, geared towards turning the solutions outlined into actionable plans.

This is one example of an engineer actively working to shift fellow engineers' and the general public's mindset on what an engineer is capable of applying their skills to.

In this same way, we as engineers can influence evidence-based policies. Through all these things, we can certainly break the mold.

Conclusion

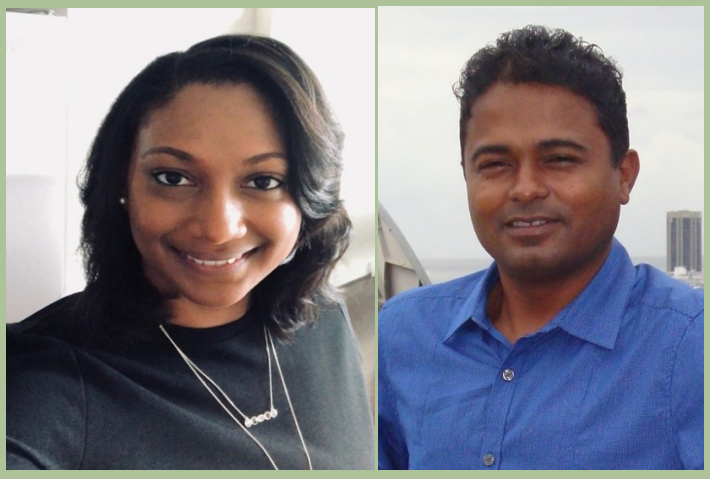

How do we diversify our thinking?

Panellists Colin Bain, Dr. Marian Watson and Ronald Adams urged IChemE TTMG to continue encouraging conversations similar to that held during this webinar, to get persons thinking of how we can do things differently and in an improved way. They provided advice that, once adopted, can propel any engineer or individual forward, such as– the guidance to be curious and make your own contributions, find opportunities, look for leadership in small things, volunteer especially outside of your core competencies or comfort zones and develop your communication skills. For the younger engineers that are looking to thrive in today's tough job market, entrepreneurship is an avenue through which they can exercise the learnings of their engineering degree, but also innovate and gain financial security. Finally, these panellists also encouraged the development of two mindsets – continuous improvement and continuous learning. IChemE TTMG hopes to host another such webinar in the upcoming year.

THE VESSEL GALLERY

Left: Dr. Shelly Singh-Gryzbon on 'A Chemical Engineer's Journey from Pipe Flow to Heart Flow'.

Right: Ms. Asia Williams on 'Climate Change and the Path to Sustainability'



Above: Ms. Ariana Emanuel and Mr. Wayne Mohan on 'Getting Chartered''

Above: Dr. Sonja Francis on 'A Chemists Perspective on the Discovery of CO2 Reduction Catalysts'

Left: Image of Panellists and Moderators at the Learned Society and Diversification of the Economy Webinar–

Panelilists– Left to Right: Dr. Marian Watson, Colin Bain, Christopher Farquhar, Ronald Adams, Maurice Massiah

10 QUESTIONS WITH CAROLINE TONI SIRJU-RAMNARINE

Tell us about yourself.
In addition to my role as Vice President of Corporate Operations at Atlantic, I also serve on the Board of Directors for AMCHAM TT and the Loan for Enterprise and Network Development (LEND), which is a microfinancing agency. I studied Chemical Engineering at the University of the West Indies, where later, in 2014 I was honoured to be a recipient of their Distinguished Alumni Award. I also have a Master's Degree in International Management from Kings College London. On a more personal note, I am married to my husband of almost twenty years and we have three children. Being their mother is my greatest joy. In my spare time, I love to create in the kitchen and I have recently found a new interest in home gardening.

How did your study of Chemical Engineering help mould you for your current role and what does this role entail?
The role of VP Corporate Operations has responsibility for a mixed portfolio of four departments - Information Technology and Systems, Sustainability and Corporate Communications, Administration and Property Services and Digital Strategy. It can be viewed as an odd combination of functions and truly, they require quite opposite skill sets. On the one hand it requires technical skills and on the other, softer, people skills. I rather enjoy this because it exercises different mental muscles at different times. As a result, I am never bored. I think studying Chemical Engineering helped me with all these fields, whether it is investigating technology to implement on a piece of process equipment or deigning a CSR intervention to solve problems and address a variety of stakeholders' needs, it teaches you how to sort complex issues, analyse information, identify the root causes of problems, and find solutions. This process, combined with careful listening and engagement of people, can be applied to almost any job or portfolio successfully.

What has been your greatest learning in the Process Safety space while working as a Chemical Engineer and does it still play a part in your current role?
It is definitely **"Speaking up".** As a young engineer, it is easy to believe that the systems that have been put in place have been designed to be robust enough and it is also easy be intimidated and overcome by the fear of asking what some may consider a silly question. Sometimes even your questions can be answered in a dismissive way by persons who tell you, "It's always been done this way" or to normalise something that doesn't seem right to you. My experience has been, if a question pops into your head, there is a reason. It means something does not seem right or clear to you and you should absolutely speak up. This is something that remains with me to today even in my current role where I do not have direct responsibility for the operations of our facility. I will still ask a question if I get that uneasy feeling whether it be while I'm on the plant or if I'm in a meeting. It is our responsibility to, regardless of our roles. This helps to guard against complacency or things that might otherwise get overlooked.

What has been your biggest accomplishment in your capacity as a Chemical Engineer and/or as a professional in general?
I would say it was when I was involved in the conception of a project in the natural gas sector from a business idea. Seeing the project through to successful commercial contract negotiations that were very lengthy and complex, to then being the Project Engineer on the engineering design, procurement and construction of this US multimillion dollar project. This project involved an expatriate secondment where I led a multidisciplinary team of engineers and technical staff comprised of both nationals and non-nationals, and then finally overseeing the successful start-up. It was exceedingly demanding and an enormous responsibility at a fairly young age, but it was an extremely rich and rewarding experience that afforded me lots of professional and personal growth.

What challenges have you experienced as a woman in leadership (the path to leadership and your in-role experience) and what advice would you give to young female Chemical Engineers that are in the earlier stages of their careers?
Sometimes I think I should stay away from these types of questions because perhaps I have controversial views on this topic. Let me start by saying, it is an irrefutable fact that women are underrepresented in leadership, especially in the energy sector. However, while there are many reasons for this, I prefer not to dwell on what has passed and be more focused on the future. I believe if we, both men and women, operate in a manner in which we are judged based on our merit, rather than gender, the world will move more quickly towards achieving this, rather than lamenting on what has been or what is. Did I have challenges? Sure I did, but using the philosophy I explained by focusing on behaving in the manner I wanted to be viewed and treated, I believe I found a way to overcome those

challenges. I have worked really hard all of my career and I most certainly did not achieve any measure of success because I was given a hand up or opportunities to meet a gender quota. I so strongly believe that women are infinitely capable of so much, that I really resent the view that women need to be helped. What we need to do instead is systemically address the things that inherently bias decision making and the progression of women. When these issues are addressed, they will benefit all of us, not just women.

How did you end up branching out from Chemical Engineering?

I have often asked myself this exact question! After years of functioning in an engineering role, I was providing technical input to a business development project which eventually materialized. In doing that I gained so much experience, way beyond the technical, that it really opened my mind to so many other things. Instead of pursuing a Master's Degree in a technical field, which is what I always said I would do, I decided to diversify instead and so I pursued the postgraduate programme in International Management. This led to a continued career in a technical path, but always mixed with other aspects of the business. A little later in my career I was appointed as Executive Assistant to the then CEO at Atlantic. This role gave me the opportunity to shadow the CEO and get the breadth of exposure to all aspects of the business. Following that assignment, I was given responsibility for the company's Sustainability and Corporate Communications department to expand my experience beyond engineering. That later grew into the VP Corporate Operations portfolio that encompasses the departments I mentioned before. In that sense it may have been something of a natural evolution, but in retrospect, I've also realized that I often get bored doing the same thing, that I really enjoy challenges and most of all, that I love learning new things. Whether it has been in the field of Communications, CSR, IT or Digital, there is something exciting about learning something new and bringing your own unique flavour or perspective to how that gets done.

How do you currently give back to society and/ or what are your plans for future work in this area?

I am involved in several charitable causes, but the one that I feel most passionately about and thoroughly enjoy doing is mentoring young professionals. Sometimes it is via formal mentoring programmes, however, I also do this informally with persons, or institutions like secondary schools and our universities locally who ask me to. While to do this justice, requires a time commitment, it is also rewarding and fulfilling, especially when you see the growth of these persons in various aspects of their lives. Rather than leaving me feeling drained or exhausted, I find that it gives me energy and hope.

Is there a greater role for corporate interface to bring about more equal STEM distribution/administration in the Trinidad and Tobago society?

The issue of STEM distribution requires an active partnership between government and key industry players. Corporations can incorporate the fundamentals of STEM learning and key concepts to children into new and existing CSR programmes, some of which are already underway. This will expose children to the possibilities of studying the sciences and how these principles can be used to solve problems. At the same time, government should make steps to speed up the introduction of core concepts like coding and programming as early as possible into the education curriculum. These concepts can be introduced as early as the primary school level. Our children are the future, and they deserve to be equipped with the tools to help them compete and excel globally.

How do you maintain work-life balance and how has it been coping during the current global pandemic?

This is a perennial challenge that Covid-19 has amplified because with remote working, it has become more difficult to separate home from work. I tell my children frequently, that time is the greatest gift you have and that if you can master the management of time, you will be successful at anything you do. What I try to do is the following: accept that there are only 24 hours in a day; determine the things that are important to me and prioritize those; decide what I will not be able to do and learn how to say no; when I am working on one of those important things, I try to work on that alone; when I am working on one thing, I try not to feel guilty about the other things that are important to me that I am not working on at that time; and most importantly, I am good to no one if I am not good to myself, so I need to make some time for myself. All of these are works in progress for me as I must remind myself of them constantly and adjust from time to time to re-centre and find my equilibrium. Also having a supportive family and caring friends who help to remind me when those adjustments are necessary has been a blessing!

What advice would you provide to younger Chemical Engineers wanting to branch away from the traditional progression path?

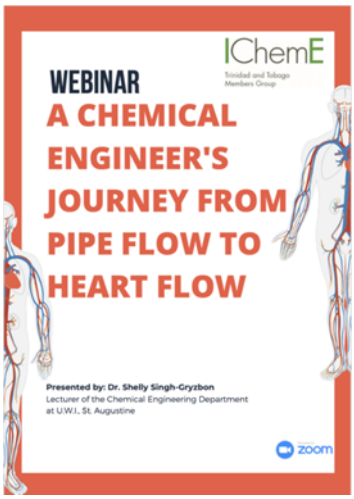
I would ask them to really think carefully about why they want to branch away. They also should have some idea about what really drives them - what they are passionate about. Then there are a couple of ways they can pursue this - it can be explored at first via a project or special assignment in their field of interest. Or maybe they can pursue educational qualifications in their desired field, which then makes them more knowledgeable and marketable in that area. On a final and somewhat riskier note, I have also seen Chemical Engineers leave the field entirely and start up their own businesses in a completely unrelated field. I think the key to success in any of these avenues, is to be passionate about what you do.

ICHEME TTMG'S WEBINAR SERIES

A CHEMICAL ENGINEER'S JOURNEY FROM PIPE FLOW TO HEART FLOW

Host: Dr. Shelly Singh-Gryzbon, Lecturer of the Chemical Engineering Department at UWI, MSc. and PhD. Advanced Chemical Engineering with Biotechnology

Date: 23rd July 2020



This webinar was the first of our online series launched amidst the stay-at-home policy during COVID-19. The speaker, Dr. Shelly Singh-Gryzbon, shared her journey as a Chemical Engineer operating in the Medical Sciences field. After graduating from the BSc. Chemical and Process Engineering programme at UWI, she was exposed to the applications of Chemical Engineering in the Biotechnology field through postgraduate studies at Imperial College, London and a fellowship at a leading cardiovascular fluid mechanics lab at Georgia Institute of Technology.

Dr. Singh-Gryzbon discussed at length her research work, which is focused on using Computational Fluid Mechanics to address the clinically relevant problems in the cardiovascular space, including but not limited to prosthetics and heart valves. A key takeaway from her delivery is that the basis for her exposure to the applications of Chemical Engineering in Biotechnology was Transport Phenomena. The application of transport principles allows for analysis of water and solute systems, drug delivery, biomaterials and blood flow (haemodynamics), which can be paralleled to the process piping systems that we are familiar with.

CLIMATE CHANGE & THE PATH TO SUSTAINABILITY

Host: Ms. Asia Williams, Climate Change Consultant, APMP, PGDip Project Management, MSc. Urban Planning and Sustainability

Date: 30th July 2020

This webinar presented the opportunity for Ms. Asia Williams, a Climate Change Consultant, to inform us of the region's endeavours with regards to sustainability and combatting Climate Change. Ms. Williams highlighted that as a region comprising Small Island Developing States (SIDS), we are at a high risk from the effects of Climate Change. As such, it is our responsibility to engage in practices and create policies that protect and utilise our region's resources in a sustainable manner.

The role of the Chemical Engineer in this effort was emphasized, with responsibilities in the areas of water, energy, food & nutrition and health & wellbeing. More specifically, the Circular Economy concept was introduced, which calls on us to adopt a system of resource utilisation where the Reduce, Re-use and Recycle concept prevails as a means to minimise production and Waste. An interactive simulation was used to predict how the development or decline in relevant areas such as type of energy supply – whether petroleum products or renewables, carbon removal methods – afforestation or technological such as CCS, amongst others, will affect the global rise in temperature.

ICHEME TTMG'S WEBINAR SERIES

GET CHARTERED

Hosts: Ariana Emanuel, CEng PMQ and Wayne Mohan, CEng (Process Safety)
Date: 13th August 2020

This webinar served to provide insight on the Chartership process and was facilitated by Ms. Ariana Emanuel, a Chartered Project Engineer and Mr. Wayne Mohan, a Chartered Process Safety Engineer. As discussed by the presenters, common motivations for becoming chartered include to demonstrate your professional competence, receive professional recognition, network with fellow professionals and enhancement of knowledge.

The Chartership process involves a series of written assessments followed by interviews. The steps typically include submission of an application, assessment of qualifications and technical report, contact of referees, assessment of the Competence and Commitment (C&C) report and an interview. After these steps, there is a Registrar review and an election panel, where the Chartership status of the individual is debated and subsequently awarded if successful. The presenters stressed the importance of preparing well for the interview, stating that every candidate's experience is likely to be different as it is tailored to the individual.

If you are an engineer aiming ultimately for Chartership status, it is important to keep a record of every activity you are involved in and every skill you adopt. This is so that when you embark on the Chartership journey, you have a complete record of your professional dossier, making the process easier for you. Another takeaway from this session is the benefit of having a mentor. The journey is

gruelling – it requires reports to showcase your competency and proof of such. Having a mentor to encourage and guide you along this journey is an added benefit.

A CHEMIST'S PERSPECTIVE ON THE DISCOVERY OF CO_2 REDUCTION CATALYSTS

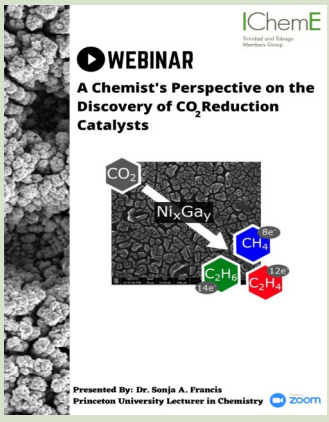
Host: Dr. Sonja A. Francis, Princeton University Lecturer in Chemistry
Date: September 28th 2020

Dr. Francis started her session by explaining the motivation behind her area of study. With the increase in global population our global energy requirements significantly increased. Compared to the 1900's we require more than three times the amount of energy to do daily living tasks. Apart from energy, chemicals are also very important to the quality of life we have for example for pharmaceuticals, clothing and food. The increase in population also increases the demand for chemicals.

Energy is generated using natural gas, crude oil and coal through combustion. Chemicals are generated from coal and natural gas through steam methane reformation. A major product of both reactions is CO_2. The challenge is that increase in CO_2 in the atmosphere correlates to temperature changes around the globe which contributes to climate change.

Dr. Francis's research explored the idea of using CO_2 as a feedstock and combining it with renewable energy sources to form chemicals and fuels. She expanded on her work on electrochemically using CO_2 to form Methanol. Her initial attempt was using a silicon wafer covered with zinc oxide and copper however the preliminary results indicated that the catalyst used wasn't stable. She then attempted to use nickel gallium which resulted in the production of methane, ethylene and ethane at decent efficiencies. Compared to copper catalysts which are typically used the nickel gallium used less energy and made more products.

This research has since triggered other researchers to explore using nickel aluminum and chromium gallium in a similar manner. The next steps will involve finding a way to do these reactions on an industrial scale.



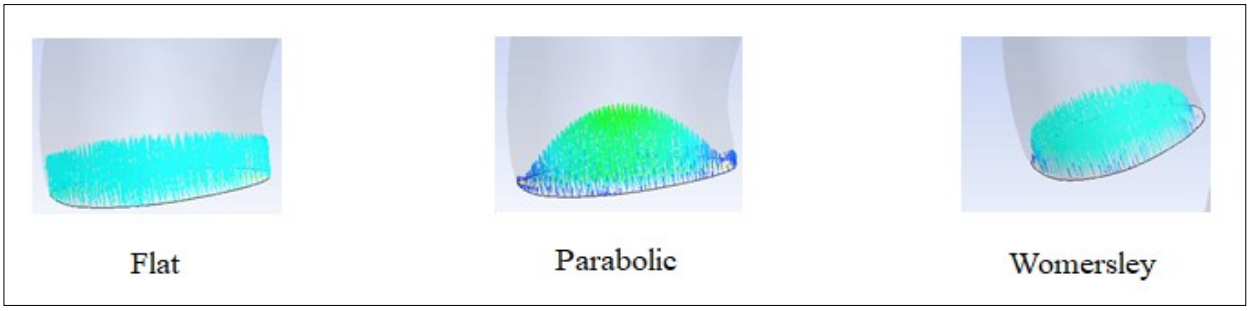


Figure 1: Inlet velocity profiles investigated.

COMPUTATIONAL MODELLING OF BLOOD FLOW IN A PATIENT-SPECIFIC AORTA

Author: Renisha Hercules, BSc. Chemical and Process Engineering

In my final year of undergraduate studies, I conducted a research project in the field of Biomedical Engineering. The nexus between my Chemical Engineering knowledge and this field was Transport Phenomena, with a focus on Computational Fluid Dynamics (CFD) methods. I am extremely grateful to my research supervisor, Dr. Shelly Singh-Gryzbon, for her expert advice and encouragement, as well as Dr. Keeran Ward and Dr. David Janes for enabling the successful completion of such a rewarding journey.

Background

Cardiovascular diseases are the leading cause of death worldwide. Diseases of the aorta are significant because of this vessel's role in blood circulation. Conditions such as atherosclerosis compromise the integrity of the arterial wall, allowing for the development of aneurysms and dissections. The initiation and progression of such pathological states have been linked to the hemodynamic conditions of the aorta. Chiefly, wall shear stress (WSS) is proven to alter endothelial cell gene expression and structure, leading to states that either promote or hinder atherosclerotic plaque formation.

CFD methods allow for visualization of blood flow and quantification of hemodynamic parameters, which can be used to formulate risk quantification methods, enable patient-specific treatment planning and optimize medical device design. Critical to the reliability of simulation results is the use of realistic boundary conditions and material property models. This is even more pertinent in a patient-specific application – for instance, an idealized inlet profile might not be practical for a patient suffering from an aortic valve disease.

Aim

The aim of my research project was to investigate the effects of boundary condition and viscosity model choice on the blood flow in a patient-specific aorta, under rest and exercise conditions, via CFD simulation.

Methodology

To achieve my research objectives, the following steps were employed to produce 8 steady-state simulations:

1. **Geometry Creation:** It is important that the geometry used is as identical to the real solid as possible. To obtain an accurate solid rendering of the patient's aorta, thresholding at 127 pixels was used to isolate the region of interest from MRI scans of the patient's torso.
2. **Mesh Generation (discretization):** An unstructured mesh was chosen to facilitate free assembly of elements within the computational domain. The aorta was discre-

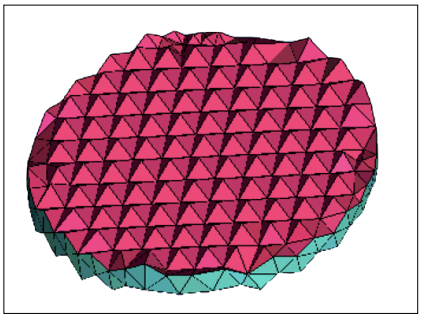


Figure 2: Tetrahedral mesh generated at aorta inlet.

tized into a tetrahedral Delaunay mesh comprising near 750,000 elements. **Figure 2** illustrates the tetrahedral mesh generated at the inlet of the aorta.

3. **Specification of material properties:** The following properties were specified for the working fluid: Newtonian viscosity=0.0037Pa·s, density=1060kg/m^3 and RMM=1kg/kmol. A rigid elasticity was chosen for the vessel's walls. The non-Newtonian Casson viscosity model suggests that over shear rates of 100s^{-1}, the viscosity approaches the Newtonian value. At lower shear rates, a decreasing exponential relationship is observed until this Newtonian viscosity is reached. For this model, a yield stress of 0.0035Pa was used.

4. **Specification of Boundary Conditions**:

i. *Inlet Sensitivity Studies* – Three idealized velocity profiles were investigated: flat, Womersley and parabolic. The flat velocity profile represents a constant velocity magnitude across the inlet. The parabolic profile was obtained using the Hagen-Poiseuille relationship. The Womersley profile represents the pulsatile nature of blood flow, and at the aorta's diameter, the Womersley parameter results in a mostly flat velocity profile with sharp descending slopes at the walls. **Figure 1** depicts these velocity profiles.

ii. *Outlet Sensitivity Studies* – The Traction Free (zero pressure), Windkessel 2-element and Windkessel 3-element models were investigated. The Traction Free model assumes that all outlets are at atmospheric pressure. The Windkessel models are lumped parameter models that describe the systemic vasculature as analogous to an electrical circuit. The 2-element Windkessel model considers the distal resistance (associated with venous and capillary branches) and the compliance of the aorta's wall, represented by a resistor and a capacitor respectively. The 3-element model includes another resistor in series to represent the viscous (proximal) resistance of vasculature immediately downstream the aorta.

iii. *Rest vs. Exercise* – Patient-specific data under exercise conditions was not available and as such assumptions were made to estimate input data during exercise, such as decreasing the cardiac cycle and estimating a target exercise heart rate, to determine a new peak velocity for the inlet velocity profile.

5. **Solving**: CFD software was used to solve the Navier-Strokes equations over the computational domain.

6. **Post-processing**: Visualization of simulation results was achieved using streamlines and contours for velocity, WSS and pressure (see **Figure 3** and **Figure 4**).

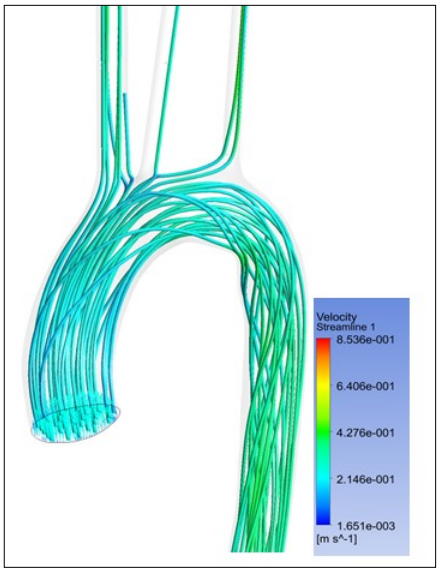


Figure 3: Velocity (flow) streamlines developed for Womersley velocity profile (with 30% of inlet flow leaving through branches and Windkessel 3-element at outlet).

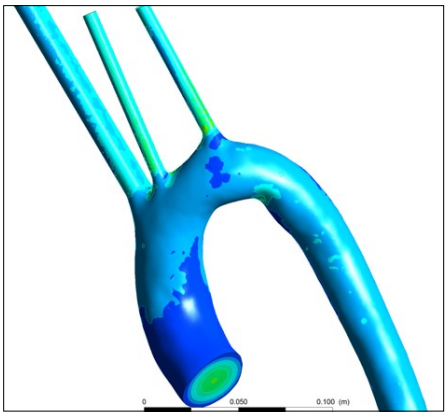
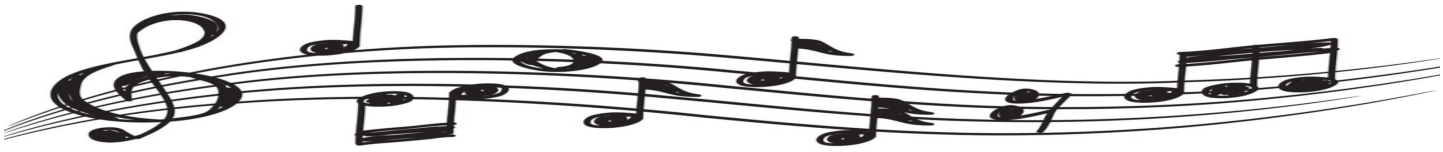


Figure 4: Wall Shear Stress (WSS) contours observed for parabolic velocity profile (with 30% of inlet flow leaving through branches and 0Pa at outlet).

Findings

The idealized inlet velocity profiles failed to capture pertinent in-vivo flow phenomena such as helical flow in the aortic arch. Outlet sensitivity studies revealed that although the use of pressure models can result in overestimation of hemodynamic parameters, the 3-Element Windkessel model provides physiologically realistic results. Comparison of simulations under rest and exercise conditions prove that CFD can be used to effectively capture hemodynamic changes occurring in-vivo as a result of exercise. Finally, the choice of blood viscosity model becomes pertinent when the computational domain experiences low shear rates, as the Newtonian model was found to underestimate the WSS compared to the Casson model in this range.



HOW ENGINEERING HELPED MY MUSIC CAREER

Author: Stefan Roach, BSc. Chemical & Process Engineering/Musician

The pursuit of Chemical and Process Engineering was very challenging for me. I chose this field motivated by my competence in Chemistry and Mathematics, but without knowledge of what a Chemical Engineer actually did. I was also disconnected from the energy industry. Whilst I liked the idea of working for a multinational energy company, I related the degree and its usefulness more to the food manufacturing sector.

Once the Engineering programme at The University of the West Indies commenced, I experienced a brief period of uncertainty, wondering if I was more suited for Medicine or even Law. Guitar studies also happened concurrently, which eventually led to my becoming the National Music Festival Champion in Classical Guitar in 2008 whilst at UWI - still grappling with Transport Phenomena and Engineering Mathematics. I subsequently began tutoring in guitar during this period, motivated by the need for some extra cash. This eventually led to the formation of 'Stefan's Guitar Academy', a school which has since exposed scores of children to the beautiful instrument.

Thankfully, my Engineering studies were successfully completed and solidified a foundation of life skills – superb transferrable skills for problem solving, application of logic and reasoning. These skills are known to traverse any area of study and are assets for any profession. As my career in music evolved, I found myself being a stickler for data collection and data-driven decision-making. Too strong of an emotional connection to your craft can easily stunt progressive decision-making. The engineer in me however, presented and analyzed data regularly, which influenced marketing decisions. These habits usually conflicted with the conventional approach of the local music industry, as colleagues wondered why I didn't pursue certain markets and adjusted my brand to suit a more mainstream following. My methodological approach, influenced by my engineering experiences, was very goal-oriented and I opted for a conservative risk portfolio. This struck the right balance for my personal musical fulfillment, niche marketing, fairly safe financial earnings and a settled and healthy family lifestyle.

After my studies, I spent 5 years at the Ministry of Energy. This experience boosted my confidence, developed my leadership skills and exposed me to some new, essential talents. My supervisor, Mr. Sheldon Butcher, exuded positivity and encouragement. I also worked for Mr. Frank Look Kin, the Technical Advisor to the Minister, who entrusted me with responsibilities that certainly enriched my life.

During my tenure, our team led a billion-dollar Petrochemical Project from proposal stage to sod-turning. I contributed to research, economic-modeling, contract drafting, and spent many late evenings in negotiations. I reminisce on this exciting time whenever I review or draft a contract for my own musical services or negotiate with a client. Whilst Economic modeling for hundred thousand dollar musical productions is laughable compared to that of a billion-dollar project, it is absolutely essential and similar principles are required. I would usually 'overkill' the modeling, exhausting all possible scenarios by considering various tiers of ticket pricing and package deals, in an effort to guarantee my success through low-risk pathways. Without major corporate backing, these skills were crucial to the production of financially successful shows annually. My innate

aptitude for numbers serves as the perfect antidote for my creative side, always enabling me to make quick, creative, but risk-averse decisions.

One experience I recall was when I presented at an International technical conference in San Diego on behalf of the Ministry in 2014. It was the first time that I traveled on my own. The skills gained in my performing career came to the fore front, helping me to deliver a well-received presentation. Many attendees remarked about the fact that I seemed so natural; how I walked the stage as opposed to other presenters who hugged the podium and how I embraced questions with good humour. The stage indeed did come so naturally.

Whilst working at the Ministry of Energy, I was part of a three-person team that traveled regionally in relation to the Petrochemical Project. This time in my life was integral to building my confidence, especially for functioning in foreign countries. As I entered the world as a full time musician and teacher, I draw parallels to this time, in initiating regional performance opportunities.

Overall, whilst my time was mostly productive and happy at the Ministry of Energy, in 2016, after almost a year of less-stimulating work coupled with unstable work contracts and bleak job prospects in the wider energy industry, I decided to make the life-changing decision and go full time into my passion. It was a calculated risk as I had already experienced 5 years of regular performance bookings and had established an excellent reputation as a guitar teacher preparing students for ABRSM (Associated Board of the Royal Schools of Music) exams. I thought that it was necessary to take the risk whilst I was still young and without much financial burden with the knowledge that if things didn't work out, there would still be time and opportunity for me to revert to the Engineering field.

Today, I feel proud of having achieved a good balance of performing and teaching that serve well for achieving my goals. I continue to embrace challenges and make calculated, progressive decisions. Engineering skills of logic and reasoning, problem solving and Mathematics continue to propel me forward, working harmoniously with my creativity. This is sometimes frustrating for my peers as I do not gravitate to many seemingly good opportunities that come my way, but I'm always balancing output with the potential returns and whether they align with my goals. It has been four years since becoming a full time musician and teacher and I am admittedly working harder than ever before, but I am thoroughly enjoying the journey.

Engineer, Musician and Teacher, Mr. Stefan Roach, in his musical element.

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28 NOVEMBER, 2020 | 9 – 11 AM

VIA ZOOM

RSVP BY 21 NOVEMBER, 2020 VIA LINK PROVIDED

Elections for the Steering and Management Committee positions listed below will be held.

All interested parties are invited to submit their nomination forms before 21 November, 2020.

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- Secretary
- Treasurer

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- UTT Representative
- UWI Representative
- BOETT Representative
- APETT Chemical Division Chair/Vice Chair/Secretary
- 3 Industry Representatives (2 of which must be members of the APETT Chemical Division Council)

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- Assistant Secretary
- Assistant Treasurer
- Technical Training and Mentorship (TTM) Committee Lead
- Applied Research Committee (ARC) Lead
- Networking, Fundraising, Sponsorship and Recognition (NSFR) Committee Lead

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28th November, 2020

Annual General Meeting & Elections

2021

- Annual Kick Off
- Technical Writing Session
- Get Chartered
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