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20 What is the Draft Carbon Tax Bill all about? Part 2 - Allowances and offsets

On Monday November 2, 2015, the South African National Treasury published for comment the Draft Carbon Tax Bill with a cutoff date for comments of December 15, 2015. To enable engineers to feel their way around the Bill, the contents have been edited for brevity and examples included to introduce the reader to the structure of the Bill as a com mentary. This is the second of a three part series.

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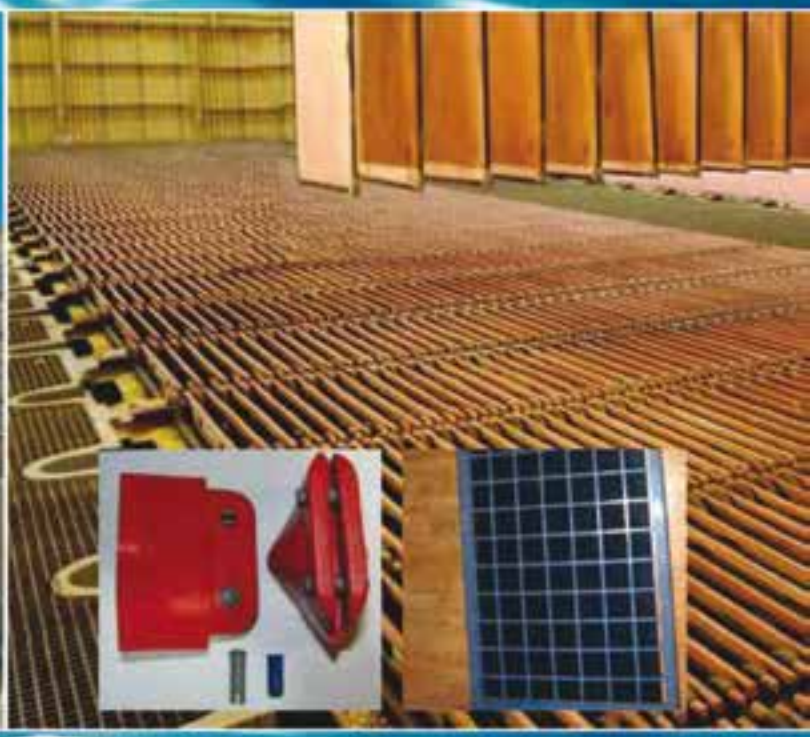

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Eliminating GMOs would affect **environment and economies**

by Brian Wallheimer for Purdue University, Indiana, USA

Higher food prices, a significant boost in greenhouse gas emissions due to land use change and major loss of forest and pasture land would be some results if genetically modified organisms in the United States were banned, according to a Purdue University (Indiana, USA) study.

Wally Tyner, James and Lois Ackerman Professor of Agricultural Economics; Farzad Taheripour, a research associate professor of agricultural economics; and Harry Mahaffey, an agricultural economics graduate student, wanted to know the significance of crop yield loss if genetically modified crops were banned from US farm fields, as well as how that decision would trickle down to other parts of the economy.

"This is not an argument to keep or lose GMOs," Tyner said. "It's just a simple question: What happens if they go away?" The economists gathered data and found that 18 million farmers in 28 countries planted about 181 million hectares of GMO crops in 2014, with about 40 % of that in the United States. They fed that data into the Purdue-developed GTAP-BIO model, which has been used to examine economic consequences of changes to agricultural, energy, trade and environmental policies.

Eliminating all GMOs in the United States, the model shows corn yield declines of 11,2 % on average. Soybeans lose 5,2 % of their yields and cotton 18,6 %. To make up for that loss, about 102 000 hectares of US forest and pasture would have to be converted to cropland and 1,1 million hectares globally for the average case.

Greenhouse gas emissions increase significantly because, with lower crop yields, more land is needed for agricultural production, and it must be converted from pasture and forest. "In general, the land-use change, the pasture and forest you need to convert to cropland to produce the amount of food that you need is greater than all of the land-use change that we have previously estimated for the US ethanol program," Tyner said.

In other words, the increase in greenhouse gas emissions that would come from banning GMOs in the United States would be greater than the amount needed to create enough land to meet federal mandates of about 15 billion gallons of biofuels.

"Some of the same groups that oppose GMOs want to reduce greenhouse gas emissions to reduce the potential for global warming," Tyner said. "The result we get is that you can't have it both ways. If you want to reduce greenhouse gas emissions in agriculture, an important tool to do that is with GMO traits."

With lower crop yields without GMO traits, commodity prices rise. Corn prices would increase as much as 28 % and soybeans as much as 22 %, according to the study. Consumers could expect food prices to rise 1-2 %, or $14 billion to $24 billion per year.

In the United States, GMOs make up almost all the corn (89 %), soybeans (94 %) and cotton (91 %) planted each year. Some countries have already banned GMOs, have not adopted them as widely or are considering bans. Tyner and Taheripour said they will continue their research to understand how expansion of and reductions of GMO crops worldwide could affect economies and the environment.

"If in the future we ban GMOs at the global scale, we lose lots of potential yield," Taheripour said. "If more countries adopt GMOs, their yields will be much higher."

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Mather + Platt's **three major brands service the chemical industry**

Earlier this month, *ChemTech* visited Dave Johnson, Marketing and Business Development Manager, Mather + Platt SA, at his Wadeville-based office in Johannesburg. He told us about the history of the company both in the UK and in South Africa and explained the range of products, in particular the three major categories of pumps used in the chemical industry.

Holding company, Worthington Pumps India (WPIL), through its international subsidiary WPIL international (Singapore), recently acquired the pump business of PSV South Africa, comprising 100 % shareholding in APE pumps, Mather & Platt SA, PSV Services SA and PSV Zambia. Mather + Platt SA, established here in 1950, is the local supplier for Viking Pump, Vanton Pump and EIM, amongst others. These three brands in particular constitute the major ones for the chemical industry, being associated, respectively, with gear pumps, chemical pumps and submersible pumps.

Viking Pump

Viking Pump offers one of the industry's broadest selection of pumping technologies. For example, the Viking range of internal gear pumps is presently selling extremely well into the South African market. This pump uses two rotating gears which un-mesh at the suction side of the pump in order to create a vacuum which pulls fluid into the pump.

Viking Pump also provides an excellent combination of application expertise and positive displacement pumping products whose design, manufacture and application of standards have ensured that they have been specified and supplied to many of the most challenging pumping applications in the world.

The large range of Viking pumps available is sold not only in South Africa but is also exported to countries such as Canada, the UK, Egypt and most African countries. Split case, multistage and end suction pumps are made specifically for water systems and have been installed into local water authorities' water systems providing water for industry and households throughout South Africa.

Dave Johnson explained that Viking pump's range is popular because of the pumps' adaptability to many different applications. Robust, rugged construction assures long life before refurbishment is required as well as trouble-free operation on normal duty installations. These pumps give outstanding performance when handling liquids at greater pressures.

Vanton Pump

An agreement signed in August 2015 makes Mather + Platt the sole distributor of all Vanton products, including Flex-I-Liner sealless peristaltic pumps, Chem-Gard horizontal centrifugal pumps and Sump-Gard vertical centrifugal pumps, as well as Flex-Plug valves and Gage-Gard instrument protectors and systems.

Each Vanton thermoplastic pump features wet-end components that are inert to corrosive chemicals across the full spectrum of pH, will not contaminate ultra-pure liquids and are also corrosion- and abrasion-resistant. Applications include liquid transfer, neutralisation, disinfection, dosing, effluent collection, lift station, odour control and recirculation.

Vanton Flex-I-Liner peristaltic type rotary pumps transfer, sample or meter acid, caustics, solvents, salts, chlorides and ultrapure chemicals, and even viscous fluids to 1 300 centistokes and slurries containing soft solids and

abrasives. They are suitable for clear, volatile liquids as well as for vacuum service and gas transfer.

Seizing problems can be avoided by using Vanton's Sump-Gard® SGK cantilevered, bearingless vertical pump. This pump features a large diameter, plastic-sleeved, stainless steel shaft that eliminates the need for immersing bearings or bushings, thus enabling the SGK pump to run-dry for indefinite periods of time. In addition, thermoplastic pumps will not wick or abrade in the way that plastic-lined pumps, elastomeric-lined pumps and fiberglass-reinforced plastic pumps may.

EIM Electric

Mather + Platt is the sole distributer for the EIM range of pumps. EIM manufactures the SV range of pumps which are intended for the transfer and handling of sediment, sludge, scale and slurries in various fields including the mining, steel, chemical, cement and ceramic industries. Liquids and slurries containing solids including clay, bentonite, fly ash, coke fines, ore, fines and cement, can be pumped because, unlike in a conventional non-clogging centrifugal pump, where the impeller is located in the water passage within the pump casing (with only a narrow clearance between the impeller and the suction cover) thus increasing the risk of clogging in this area, in the vortex type pump, the impeller is recessed in the side of the casing and consequently most of the water containing solids has free passage. This free flow is induced by the vortex created by the impeller rotation. The gap between the impeller and the suction cover is the same width as the discharge port, allowing the free flow of solids. As is the case with the non-clogging vane, the solids being pumped do not pass through the impeller but in the vortex passage, minimising wear to the impeller.

Conclusion

Mather + Platt pumps are manufactured to ISO 9001 quality certification backed by computer-aided design and test facility, all supported by a full spares and service organisation. "All our pumps are manufactured to ISO 9001-2008. We have in-house inspectors who inspect the raw castings before and after machining. Once pumps are assembled, they are inspected again before despatch," Dave explained, remarking that the company's range of pumps can be relied upon for years of service under the most difficult conditions.

The company offers officially manufactured spares, manufacturer-warranted repairs, as well as new pumps and valves. "Being owned by WPIL enables Mather + Platt to obtain materials such as Super Duplex for pumping corrosive water, such as sea water. In addition, we have a long established business relationship with our suppliers of electric motors, mechanical seals, bearings, and so on. This has led to good delivery and assistance from these suppliers," said Dave.

For more information on APE Pumps and Mather+Platt, please contact Dave Johnson, Marketing & Business Development Manager, Mather+Platt on tel: +27 11 824 4810/079 490 7428, email dave@matherandplatt.com or go to www.matherandplatt.com.

The blackest paint **that sucks all light**

by Gavin Chait

"The technical term for it," declare Terry Pratchett and Neil Gaiman in their astute treatise 'Good Omens', "is infrablack. It can be seen quite easily under experimental conditions. To perform the experiment simply select a healthy brick wall with a good runup, and, lowering your head, charge. The colour that flashes in bursts behind your eyes, behind the pain, just before you die, is infrablack."

I imagine they were describing Vantablack, developed by Surrey NanoSystems. There is a freaky YouTube clip you can watch if you so desire. A crumpled sheet of aluminium foil is rotated. On one side is an ordinary bit of reflective silver metal. On the other ... there's a hole in the universe.

The original Vantablack absorbs 99,96 % of all light that hits it. It has now been improved to a point that its absorption index can no longer be measured since there's no way to do so.

As you watch that clip and contemplate the full haunting horror of it, you'll want to grab hold of the scientists at Surrey's Advanced Technology Institute and demand, 'Why? Why?'

And then you read Michael Vlasov's blog. Vlasov is an Israeli electro-optical engineer and amateur astronomer. In a deeply detailed 'how to', he describes how to improve the light absorption of his Orion telescope. "A Newtonian reflector's open tube (or any other OTA for this matter) is an attractive target for unwanted stray light, which can come from anywhere: Moon, street lights or even bright stars. This light bounces off telescope's inner surfaces and eventually enters the focuser and the eyepiece. As a result, the background lightens up and the image contrast is harmed."

The original paint in his very expensive telescope isn't good enough. So he describes how to take it apart and carefully cover the interior tube of the scope with ... paper. Special black paper, but paper nevertheless.

His paper is produced by ProtoStar and is self-adhesive flocking paper and is especially designed for telescopes. The problem is that it's paper and so can only cover smooth and regular surfaces. Not all surfaces are like that.

Gerd Neumann produces a deep-black optical paint which is effectively just chalkboard paint. They suggest – and I'll quote this – "To improve the effectiveness of the colour, you can add a fixed amount of finely sifted sand, poppy seed or flour to the paint. After this treatment, the coating gets an extra rough finish so that even with a glaring reflection of the sun or a halogen lamp the surface remains pitch black. (Please try to figure out the mixture ratio by yourself. The paint should be very, very smooth in its consistency. A good starting point is a volume ratio of 1:1.)"

And then there's the problem with space flight. The paint has to survive the intense high-frequency oscillations of the launch, not losing bits and pieces that interfere with instrumentation, and require no maintenance for the lifetime of the orbital instrument.

The Hubble Telescope, famously, suffered from a 2,2 micrometre 'flatness' in the perimeter of its main mirror. This necessitated a major repair job. It was launched in 1990 and first serviced in 1993. It's been up there for over a quarter of a century.

NASA developed a super black coating called — wait for it — 'super-black'. The basic principle of these coatings is to use carbon nanotubes. Carbon tubes arranged tightly and vertically are not only black, but the nature of the structure means that light is absorbed into the tubes, reflected internally and dissipated as heat.

Very little light escapes. The problem is in creating these dense vertical nanotube structures. The process is a familiar

one in nanotech: atomic layer deposition (ALD). Used most commonly in the production of microprocessors, by alternating a sequence of gas deposition on a substrate, complex nanoscopic components can be created. (Chemical vapour deposition is similar to ALD but here the different vapours are never present simultaneously.)

NASA's problem is that its approach requires the oxide-coated objects to be baked at 750 °C . That seriously limits the nature of the objects they can coat as well as introduces new problems. A new spectrograph added to Hubble in 1997 underwent thermal expansion and shortened the lifespan of the instrument.

In 2014, researchers at Surrey University released a paper entitled "The partial space qualification of a vertically aligned carbon nanotube coating on aluminium substrates for Earth Orbit applications". Evangelos Theocharous, Christopher Chunnilall and their colleagues described the low-temperature fabrication of "NanoTube Black, a Vertically Aligned carbon NanoTube Array (VANTA) on aluminium substrates".

Low-temperature in their case means 400 °C. This massively increases the range of materials they are able to coat. Their first commercial orders were delivered to clients in July 2014. Clients in the aerospace industry tested the material for mass loss, outgassing, shock, vibration and temperature cycling. It passed happily.

The Hubble is reaching the end of its work life and its successor, the James Web Space Telescope, is being developed with a launch target of 2018. It's highly likely that VantaBlack will be used as a coating.

Fortunately for Surrey NanoSystems, there's more work out there than the occasional space telescope. There are a large number of sensors which measure light but need to suppress stray light. Solar collectors are used to absorb radiation and convert it into heat. And there are a few more: spectroscopy used in medical diagnostics (eg, in blood tests), cinematography (both on production and in projection), and in architecture.

One of Surrey NanoSystems latest developments is a spray paint version. This only absorbs 99,8 % of incident light (compared to their main product's 99,965 %) but it can be applied at room temperature to any object.

The British Science Museum currently has a display one can visit. Ben Jensen, at Surrey NanoSystems, makes a minor dig at NASA in his comments about the display: "Vantablack S-VIS is so effective that its performance far outstrips any other known paint or super-black coating, achieving a reflectance of just 0,20 %. This is significantly less reflective than, for example, the super-black paint used for managing stray-light in the Hubble Space Telescope."

Sir Anish Kapoor, an architect and sculptor, intends using VantaBlack in a new artwork (after he gets his security certification because this is a listed product).

Both NASA's super-black and Surrey NanoSystems' Vantablack have a very wide light absorption range, including for non-visible light (many space-based sensors operate beyond even the infrared and ultraviolet ranges). So do radar systems. Black coatings that can go on any surface, survive extreme conditions, and which reflect almost no light are rather useful in converting almost any aircraft into a stealth vehicle. But let's put those unhappy thoughts aside for the moment and think instead of art. As Sir Anish Kapoor said when discussing his plans for VantaBlack, "Imagine a space that's so dark that as you walk in you lose all sense of where you are, what you are, and especially all sense of time."

And that's plenty scary on its own, wouldn't you say?

NanoChOp project highlights value of NanoSight for monitoring in biological systems

Researchers working on the European Metrology Research Project NanoChOp (Chemical and Optical Characterization of Nanomaterials in Biological Systems), funded by EURAMET, have concluded that the NanoSight Nanoparticle Tracking Analysis system from Malvern Instruments offers unique insight into the behaviour of nanoparticles in biological systems. Such insight supports ongoing efforts to assess the potential risks to human health posed by the increasing use of nanomaterials.

Dorota Bartczak, Researcher in Inorganic Analysis at LGC (a global leader in the laboratory services, measurement standards, reference materials, genomics and proficiency testing marketplace) commented that "measurement methods and techniques that provide reliable data for researchers to understand how nanoparticles behave in complex biological systems are crucial for the human risks assessments needed to ensure that the increasing use of nanomaterials does not endanger public health.

"The NanoSight system measures nanoparticle size, concentration and surface charge simply and quickly. Recent software upgrades have enhanced its capabilities and we can now successfully study individual nanoparticle populations at the high serum concentrations that reflect conditions in nanotoxicology models.

"NanoSight uses Nanoparticle Tracking Analysis to measure number-based particle size distribution and concentration measurements, so it is clear exactly how many particles of any specific size are present," said Dr Bartczak. "Number-based measurements are critical to meet EU regulations relating to the testing of foods and cosmetics, but they also enable the direct study of critical processes such as agglomeration. With NanoSight we can see an increasing population of larger particles and a simultaneous reduction in particle concentration as agglomeration occurs. Such analysis makes it easier to reliably assess the characteristics of these complex nanoparticle systems."

For more information contact Alison Vines, Malvern Instruments on tel: +44 (0) 1684 892456 or email: alison.vines@malvern.com.

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The Litesizer™ 500 is an instrument for characterizing nano- and microparticles in dispersions and solutions. It determines particle size, zeta potential, and molecular mass by measuring dynamic light scattering (DLS), electrophoretic light scattering (ELS), and static light scattering (SLS).

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- The Litesizer™ 500 uses cmPALS, a novel patented (European Patent 2 735 870) PALS technology that leads to shorter measuring times and lower applied electric fields. The result: sensitive samples can be measured with less deterioration.

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LNG vaporisers selection
based on site ambient conditions – Part 2

by John Mak, Senior Fellow and Technical Director,
Nick Amott, Curt Graham, Dhirav Patel, Fluor, USA

Part 1 of this article appeared in the August 2015 issue of *Chemical Technology*. Today's LNG landscape is changing. Many of the newer LNG import terminals are smaller in size and are mainly located in South East Asia and South America. These new terminals place a strong emphasis on energy efficiency, environmental impacts and emissions.

Heat integration with power plant

Simple cycle power plant

Where the regasification plant is located close to a power plant, a hybrid type system using waste heat from the gas turbine and Submerged Combustion Vaporisers (SCVs) for LNG heating can increase the thermal efficiency of the integrated facility.

The heat integration scheme for a simple cycle power plant can be illustrated as shown in Figure 7. In this configuration, hot water is used as an intermediate fluid. The circulating water is heated by the hot exhaust gas from the gas turbine in a direct contact heating tower. When waste heat recovery is operated, the fuel gas burners of the SCVs are not required; the LNG vaporisation duty is supplied by the circulating hot water.

Fuel firing with SCVs is only required when the power plant is not operating or when the quantity of waste heat is insufficient to support the regasification duty.

With the use of waste heat, there are significant energy savings, in addition to the reduction in CO_2 and NOx emissions from the facility.

In addition, the chilled water from the LNG plant can be used to lower the gas turbine inlet temperature using an exchanger. This is particularly advantageous when operating during hot summer days when the gas turbine output typically drops due to higher ambient temperature. Lowering the gas turbine inlet temperature can significantly increase the power output as shown in Figure 8.

Typically, for each degree centigrade drop in air temperature, power output can be increased by 0,7 to 1,2 % depending on the gas turbine aerodynamic design characteristics. Typically, aero-derivative gas turbines are designed with a higher compression ratio and higher efficiency than industrial gas turbines, and would benefit more with inlet air chilling, as shown in Figure 8.

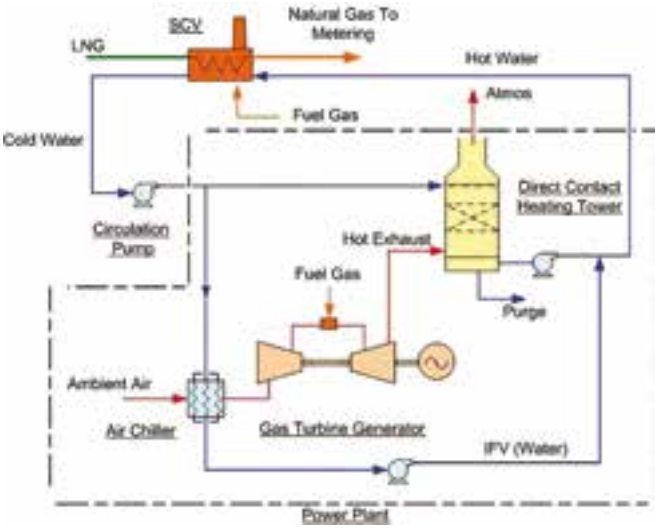

Figure 7: Simple cycle power plant integration

Combined cycle power plant

For combined cycle power plants, low pressure steam is condensed in the surface condenser in the steam cycle using cooling water. The cooling water return can be used to supply heating to the LNG plant as shown in Figure 9. This integration method is currently employed in the large Grain CHP station to increase thermal efficiency and reduce emissions. The thermal efficiency of an

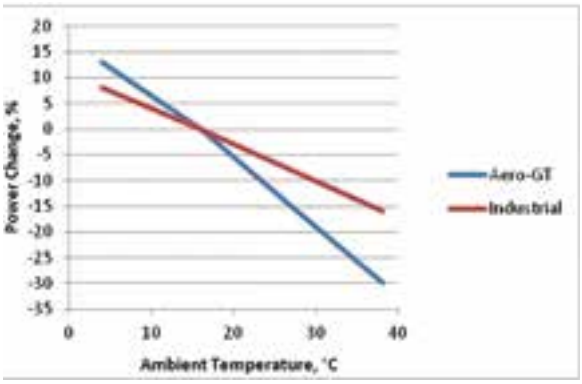

Figure 8: Typical gas turbine performance vs ambient temperatures

advanced combined cycle power plant is close to 60 %, and with waste heat recovery using LNG, the overall thermal efficiency can be improved to over 70 %. Note that the Grain LNG terminal is a world scale plant with a capacity of 14,8 million tonnes per year.

Comparison of vaporiser options

The optimum choice of an LNG vaporisation system is dependent on the terminal's capacity, site conditions, environmental and regulatory permits, and opportunities for waste heat recovery. Note that the current study is developed for today's small to mid-scale LNG terminals. The results may be different for large scale LNG terminals.

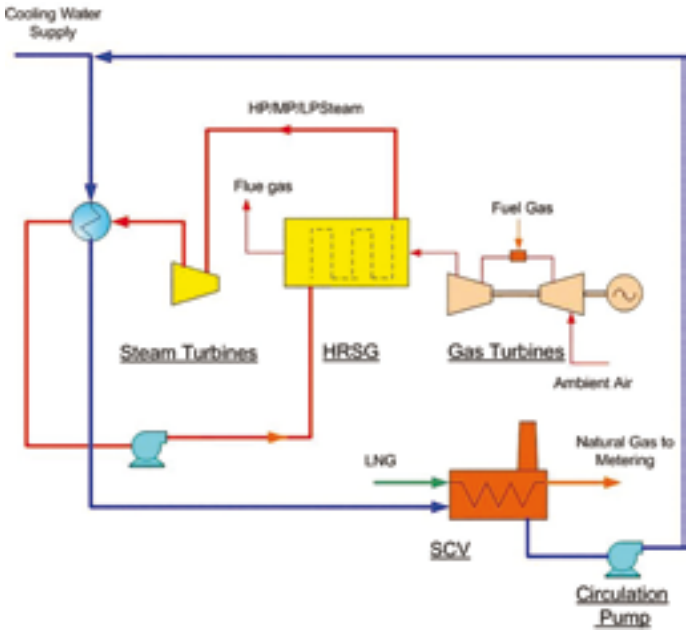

Figure 9: Combined cycle power plant integration

Table 1 compares the seven vaporiser options in term of their applications, operation and maintenance, utility and chemical requirements, environmental impacts and relative plot sizes.

The seven options considered in this study are:

- Option 1 uses ORV as in existing regasification terminals

Table 1: Qualitative comparison of LNG vaporisation options

Options	1	2	3	4	5	6	7
VAPORISER TYPE	**ORV**	**IFV**	**IFV**	**IFV**	**SCV /WH**	**SCV alone**	**AAV**
HEATING MEDIUM	**Seawater (SW)**	**Propane (C3) / Seawater (SW)**	**Glycol-water (GW) / Air**	**Glycol-water (GW) / Seawater**	**Hot Water (HW) Fuel Gas (FG) /Waste Heat (WH)**	**Hot Water (HW) Fuel Gas (FG)**	**Air**
FEATURES	Direct LNG vaporization using sea water	Indirect LNG vaporization by condensing propane which is heated by seawater	Indirect LNG vaporization by glycol which is heated by air fin exchanger	Indirect LNG vaporization by glycol which is heated by seawater	Indirect LNG vaporization by hot water which is heated by waste heat and SCV	Indirect LNG vaporization by hot water which is heated by SCV	Direct LNG vaporization using air
MAJOR APPLICATION	70% base load plants use ORV	Cold climate application. Avoid seawater freezing	For warm climate application. IFV makes up 5 % of base load plants	Similar to Option 3 with seawater being used	Heat integration with power plant	SCV is used in 25% of base load plants	For warm climate application, where space is available
OPERATION & MAINTENACE	Cleaning and maintenance of seawater system	More complex operation. Similar to Option 1 plus propane power system	Easy operation. Avoid seawater from freezing.	More complex operation. Similar to Option 1 plus a glycol heating system	More complex operation. Require coordination with power plant operators	Simple operation and low maintenance	Cyclic operation. Require defrosting.
UTILITIES	Seawater and electrical power	Seawater and electrical power	Electrical power only	Seawater and electrical power	Fuel gas and electrical power	Fuel gas and electrical power	Electrical power only
CHEMICALS	Bio-treatment chemicals and chlorination	Same as Option 1 with lower chlorination	None	Same as Option 1 with lower chlorination	Chemicals for pH control of SCV water. SCR for NOx reduction	Chemicals for pH control of SCV water. SCR for NOx reduction	None
EMISSION & EFFLUENTS	Impacts on marine life from chemicals and cold seawater discharge	Impacts on marine life from seawater system. Rankine cycle reduces air emissions.	None	Impacts on marine life from seawater system.	NOx, CO_2 emissions and SCV condensate	NOx, CO_2 emissions and SCV condensate	None
SAFETY	Proven to be safe	Propane system poses a safety concern	Inherently safe	Inherently safe	Safeguards must be provided for the waste heat and fuel gas system	Safeguards must be provided for fuel gas system	Inherently safe
PLOT	Medium Size	Medium Size	Large Size	Medium Size	Small Size	Small Size	Large Size

Table 2: Vaporiser rankings for ambient above 18 °C

Option	Vaporiser / Heat Transfer Fluid	Environmental	Operability	Maintain-ability	Total	Rank
1	ORV (SW)	5	3	3	11	3rd
2	IFV (C3/SW)	5	6	5	16	6th
3	IFV (GW/Air)	3	1	1	5	1st
4	IFV (GW/SW)	4	4	4	12	4th
5	SCV (HW (FG) /WH)	1	7	7	15	5th
6	SCV (FG)	7	5	5	17	7th
7	AAV (Air)	2	2	2	6	2nd

- Option 2 uses propane in an IFV Rankine cycle with seawater as the heat source.
- Option 3 uses glycol water in an IFV with air as the heat source.
- Option 4 uses glycol water in an IFV with seawater as the heat source.
- Option 5 uses SCV using fuel gas and waste heat from a cogeneration power plant.
- Option 6 uses SCV using fuel gas alone.
- Option 7 uses ambient air vaporiser (AAV).

Rankings of vaporisers

The seven options in Table 1 are ranked for their performance in terms of environmental impacts, system operability and maintenance requirements.

Environmental impacts are evaluated based on effluents, air emissions and fuel consumption. Depending on site locations, fuel consumption can significantly increase OPEX considering today's high energy cost.

However, the evaluation criteria for small regasification terminals are different than their larger counterparts. For the large terminals, capital cost and operating cost play the deciding factors. With adequate staffing in large terminals, operational complexity can often be overcome. However, for smaller terminals, ease of plant operation and lower maintenance requirement are more important due to the limited staffing. Process simplicity and operability are preferred since capital costs of the different options are often comparable (site dependent).

For these reasons, the selection is mainly focused on evaluating the environmental factors, system operability and maintenance requirements.

The ranking system is based on a score of 1 to 7, with 1 being the most desirable and 7 the least desirable. These

Table 3: Vaporiser rankings for ambient below 18 °C

Option	Vaporiser / Heat Transfer Fluid	Environ-mental	Oper-ability	Maintain-ability	Total	Rank
1	ORV - SCV (SW - FG)	2	1	3	6	1st
2	IFV - FH (C3/SW - FG)	1	6	5	12	4th
3	IFV - FH (GW/Air - FG)	5	3	1	9	3rd
4	IFV - FH (GW/SW - FG)	3	2	4	9	2nd
5	SCV (HW (FG) / WH - FG)	1	7	7	14	5th
6	SCV (FG)	7	5	5	17	7th
7	AAV - SCV (Air - FG)	6	4	2	12	5th

Table 4: Vaporiser design and capacity for 3 MTA regasification plant

Vaporiser Option	1	2	3	4	5/6	7	1	2	3	4	5/6	7
Heating Medium Fluid (HTF)	SW	C3 / SW	GW / Air	GW / SW	HW (FG) / WH	Air (AAV)	SW	C3 / SW	GW / Air	GW / SW	HW (FG) / WH	Air (AAV)
Minimum Site Ambient Temperature	Above 18 °C						Below 18° C					
Number of Vaporisers	2					28	2					28
Operating Capacity of Each Vaporiser, %	50					15	50					15
Number of SCVs	1					-	3					
Operating Capacity of Each SCV, %	50					-	50					

scores are summed and the one with the lowest score is considered the most desirable option.

Vaporiser rankings for warm climate location

In warm ambient site locations, such as in an equatorial zone, where the site ambient temperature stays above 18 °C, the ambient air vaporisers or the air heated intermediate fluid type vaporiser units can provide the full LNG vaporisation duty without trim heating. In addition, there is potential revenue to be gained by collecting and marketing the water condensate from the air.

In terms of environmental scoring, Option 5 which uses waste heat from a power plant to increase overall plant efficiency is the most desirable. This option receives the best score in terms of environmental impacts. However, for small to mid-scale LNG terminals, the management of waste heat and the coordination with the power plant operators requires additional staffing and control which may not be available in small terminals, and, therefore, it is considered not favorable despite their environmental advantages.

For the hot climate zone, the environmental scores for air heating (Option 3 and 7) are desirable followed by the seawater heating options (Option 1 and 4). The SCV (Options 6) which uses fuel gas for heating generates air emissions and is the least desirable.

The use of propane as an intermediate fluid (Option 2) adds operating and maintenance complexity, which is not desirable for small LNG terminals. For these reasons, the propane heating system is among the least desirable options.

For operability and maintainability, air heating (Option 3 and 7) is the simplest to operate and maintain. Option 3 using an intermediate fluid with the air heater, which eliminates the cyclic defrosting operation required for AAV and is ranked the most desirable.

For warm climate operation, the use of air heater with intermediate fluid or direct air heating with AAV are more favourable than other options.

Vaporiser rankings for cold climate location

In cold ambient site locations in sub equatorial zones, where site ambient temperature drops below 18 °C, heating medium systems using ambient heat sources of seawater or air will not be able to meet the vaporisation duty. When the site ambient temperature is below 18 °C, external heating is required for all options. Consequently, all IFV options, supplemental heating integrated with SCV or FH (Fried Heater) must be provided during the winter months.

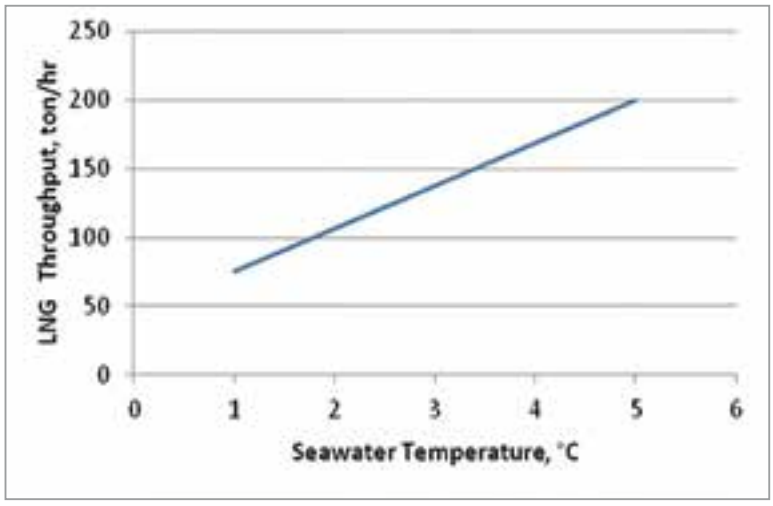

Figure 10: Impact of seawater temperature on LNG throughput

Similar to the warm ambient options, Option 5 which uses waste heat from the power plant is the most desirable in the environmental ranking. However with the limited staffing in small LNG terminals considered in this study, the additional complexity cannot be justified and this option is considered not favourable.

In the cold climate areas, ambient air temperatures fluctuates more than seawater temperatures. Therefore, the air heating options require more fuel gas heating during winter operation. Due to the higher fuel consumption, air heating (Option 3 and 6) is less desirable than the seawater heating options (Option 1 and 4).

In cold climate operation, the use of seawater heating in combination with SCV ranks the most desirable.

Cold seawater impacts on LNG throughput

When seawater temperature drops during winter, ORVs can continue to operate but at a reduced rate, as long as the freezing temperature of seawater (typically at -1,5 °C), as shown in Figure 10. During cold winter operation, the exit gas from the IFV exchanger is trim heated using the fuel gas.

Table 5: Vaporiser design and capacity for 0,3 MTA regasification plant

Vaporiser Option	1	2	3	4	5/6	7	1	2	3	4	5/6	7
Heating Medium Fluid (HTF)	SW	C3 / SW	GW / Air	GW / SW	HW (FG) / WH	Air (AAV)	SW	C3 / SW	GW / Air	GW / SW	HW (FG) / WH	Air (AAV)
Minimum Site Ambient Temperature	Above 18 °C						Below °18 C					
Number of Vaporisers	2					4	2					4
Operating Capacity of Each Vaporiser, %	100					50	100					50
Number of SCVs/Fired heater	-						2					
Operating Capacity of Each SCV/ Fire Heater, %	-						100					

Number of vaporisers and capacity for baseload plants

The number and capacity of vaporisers for the above options are analysed for two regasification plant capacities: 3 MTA (million tonnes per annum) and 0,3 MTA. The 3 MTA plant is considered as the typical baseload plant in recent projects. The 0,3 MTA is the plant size that can be used to supply fuel gas to a 300 MW combined cycle power plant and is considered as a 'fit for purpose' regasification plant.

Table 4 and Table 5 summarise the number of vaporisers and operating capacities for each of the options for these two plant capacities.

The numbers of vaporisers are determined by the maximum size manufactured by the vaporiser vendors, operating philosophy and sparing requirements. The design capacities of these vaporisers are:

Vaporiser Type	Maximum Capacity LNG ton per hour
ORV	300
IFV / SCV	200
AAV	5

• 3 MTA LNG terminal

As shown in Table 4, for the 3 MTA baseload terminals where ambient temperature is always above 18 °C, vaporiser configuration can be a combination of 2 x 50 % ORV/IFV and 1 x 50 % SCV on standby. The number of AAVs is 28 units. Note that only about half of the number of AAVs is used for heating while the remaining units are on the defrosting mode at any one time.

Where the ambient temperature drops below 18 °C, the number of SCVs must be increased to three to accommodate the higher duty during winter months. Each vaporiser is designed to operate at 50 % of the design capacity.

• 0,3 MTA LNG terminal

For the smaller 0,3 MTA plant, the combination of vaporisers can be 2 x 100 % for ORV/IFV operating as shown in Table 5. The number of AAVs is 4 units, with half of the number of AAVs used for heating while the remaining units are on the defrosting mode at any one time. Where the minimum site ambient temperature falls below 18 °C, the number of SCVs must be increased to 2, with one operating and one on standby mode.

Conclusions

For fuel savings and minimizing greenhouse gas emissions, use of 'free heat' from ambient air, seawater or waste heat from adjacent power plant is the most desirable. Fuel gas should only be used for trim heating during cold winter months, used as a backup heating to cover for outage/ maintenance or for peak operation. The vaporiser design option selection is different depending on plant capacities and ambient conditions. For the small to mid-scale LNG terminals, for the equatorial regions where ambient temperatures are fairly mild and stay above 18 °C, the use of ambient air for heating is the optimum choice.

Air heating can be integrated with a heat transfer fluid using air fin exchangers, or using standalone Ambient Air Vaporisers. For the subequatorial regions, fuel gas firing is required during winter. Seawater heating has an advantage over air heating as the seawater heater can operate for a longer period than an air heater, which reduces fuel gas consumption in the trim heating. Considering today's smaller regasification terminals, particularly the 'fit-for-purpose' design for small power generation plants, the selection of vaporiser options can be quite different compared to the larger LNG terminals.

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Mokhatab, S., Mak, J., Wood, D., Valalppil, J., "Handbook of Liquefied Natural Gas", Elsevier Publishing, October 2013.

New vibration level switch for extreme process conditions

With the new OPTISWITCH 5300 C, KROHNE presents a vibration level switch for liquids that can withstand extreme process conditions such as hot or cryogenic temperatures and high process pressure. The application area ranges from chemical or oil & gas related industries, marine (LNG) tankers to steam generation.

OPTISWITCH 5300 C provides overfill prevention, high/low level alarm, or dry run protection for pumps in liquid applications with a temperature range from -196...+450°C / -321...+842°F and pressure range from -1... 160 barg / -14...2,320 psig. Insertion lengths are available up to 3 m / 9.8 ft with a wide variety of sensor materials and process connections. The wetted parts of OPTISWITCH 5300 C are made of Inconel Alloy 718 with 316L or Hastelloy C-22. Communication options include 2-wire 8/16 mA output, relay (DPDT) and transistor PNP/NPN electronics.

The new level switch features Ex, WHG (German Wasserhaushaltsgesetz), various ship approvals and fulfills the requirements for use in boilers and auxiliary installations according to EN 12952-11 (water tube boilers) and EN 12953-9 (shell boilers). OPTISWITCH 5300 C is designed for use in safety loops: as a single device for a single safety function (1oo1), it meets SIL2 architecture, in a homogenous redundant setup, it meets SIL 3 (1oo2) architecture.

The new switch adds to the KROHNE range of vibration level switches that provide accurate and reliable point level detection: the OPTISWITCH 4000 and OPTISWITCH 5000 series are designed for liquid applications, while the OPTISWITCH 3000 series is designed for use with solids.

For more information contact
John Alexander on
Tel.: +27 11 314 1391; email:
salesza@krohne.com;
or go to www.krohne.com

Vibration level switch OPTISWITCH 5300 C for extreme process conditions

High frequency for small vessels

The unrivalled focusing of VEGAPULS 64 allows for more flexibility in the chemical industry.

The current trend in the chemical industry is towards smaller, specialised batches. This results in equipment and containers with reduced volume. But engineers everywhere, including those in technical centres and pilot installations, ran up against limits again and again when they tried to use radar level measurement technology in very small production setups. Factors such as the dead band of the sensors, the size and design of the antennas as well as the measurement uncertainty at the tank bottom often led them to use weighing systems or pressure transmitters instead.

The new VEGAPULS 64, the world's first radar level sensor for liquids with 80 GHz, now has an antenna system integrated directly into the process fitting. Since no antenna protrudes into the vessel, it is possible to measure up to the process fitting itself. This gives greater flexibility because practically all of the container volume can be utilized.

Thanks to the tightly focused measuring beam – with an antenna diameter of 80 mm, the transmission signal has an opening angle of just 3° – using the instrument in tanks with heating coils and agitators has become much easier. Another advantage of VEGAPULS 64 is its larger dynamic range, which results in higher measurement certainty, especially when there is buildup, condensate, foam or a turbulent liquid surface in the vessel.

In recent years, non-contact radar level measurement technology has taken over many applications in the chemical industry. The big advantage of radar technology is its immunity to process conditions such as temperature, pressure and density. With the new VEGAPULS 64, levels can now be measured in applications where the process and/or structural conditions were previously not suitable for radar.

For more information contact
Chantal Groom on +27 11 795 3249 or email chantal.groom@vega.com; or go to www.vega.com.

Story by Jürgen Skowaisa, Product Management Radar, Germany

Rockwell Automation offers a series of seven safety webinars

Rockwell Automation is offering a series of safety webinars which explore designing safety for seven specific types of machines.

The company will present an overview of the latest safety and automation technologies, application techniques and tools to help users further their knowledge when designing, implementing, maintaining and using machines with integrated safety.

The first webinar was on 10 March. The next six will be as follows:

- Palletiser machinery
  7th April 2016 - 10:00 (CET)
- Vertical form, fill and seal machinery
  11th May 2016 - 10:00 (CET)
- Simple robotics machinery
  8th June 2016 - 10:00 (CET)
- Tension control machinery
  13th July 2016 - 10:00 (CET)
- Filling and dosing machinery
  11th August 2016 - 10:00 (CET)
- Cutting and forming machinery
  14th September 2016 - 10:00 (CET)

To sign up for any of the webinars, please visit:
http://campaign.rockwellautomation.com/EMEA_WB_SAFETY_FY2016
or contact Michelle Junius on tel: +27 (0)11 654 9700 or
email mjunius@ra.rockwell.com.

Keller's answer to static and highly dynamic pressure measurements

Keller, leading manufacturer of measuring technology such as isolated pressure transducers and transmitters, represented in southern Africa by Instrotech, is setting new standards with its M5 series.

The key to measuring highly dynamic pressure variance is to achieve, as far as possible, a direct connection between sensor element and medium. Keller's development team has come up with a micromechanical solution without media isolation diaphragm (with its damping effect), capillary tubing, sealants or adhesives. In the M5 series, the rear of the silicon sensor is soldered to a supporting element designed for excellent fluid dynamics, which in turn is secured flush at the front of the pressure connection. This sophisticated design enables dynamic measurements with a bandwidth of 0...50 kHz and offers a number of additional benefits. These include excellent decoupling of mounting forces and structure-borne vibration, extensive media compatibility and the durability offered by the anti-oxidation coatings.

The pressure sensors in the M5 series are intended for operating temperatures between -40 °C and +180 °C with a narrow total error band (ie, including temperature errors) of ±1 %. Without the remote signal converter, they come with a typical output signal range of 80 mV (based on a 1 mA supply) and an individual calibration certificate. The 3 bar, 10 bar and 30 bar measurement ranges are available for absolute pressure measurements.

To avoid any reduction in the piezoresistive pressure sensor's broad dynamic range of 50 kHz, the development team at Keller has opted not to digitise the measurement signal to be produced. Instead, the purely analogue signal path is adjusted in real time via the compensation electronics, which are fully controlled by a microprocessor. This ensures the output signal, amplified to 0...10 V, retains the full dynamic range of the sensor signal. The measurement system, consisting of the pressure sensor and signal converter, undergoes an end-to-end calibration at the factory once the customer-specific parameters have been determined.

The thermally ultra-robust pressure transducers in the Keller M5 series support high precision static and dynamic measurements up to a bandwidth of 50 kHz and at working temperatures of up to 200 °C at the pressure sensor. With its M5 connection thread, the remote pressure sensor – which contains no oil and associated isolation diaphragm and no sealant or adhesive in contact with the media – is ideal for taking highly dynamic measurements at close proximity.

For more information contact
Instrotech on +27 010 595 1831 or email sales@instrotech.co.za.

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CHEMICAL TECHNOLOGY: FOCUSING ON WATER PROBLEMS AND SOLUTIONS IN SOUTH AFRICA

As we enter the new year of 2016, it is imperative that our magazine, 'Chemical Technology' (ChemTech) focuses on those matters of greatest urgency for the future, not only of our country, but of the world. The magazine will therefore be concentrating on providing a platform for investigation into the problems facing South Africa at this time, which, indeed, are very much the same as those faced in the rest of the world.

The World Wildlife Fund-SA states in its 2014 Report, 'Understanding South Africa's most urgent sustainability challenge': "We live in an interconnected, interdependent world. This idea, of intersected systems that underpin our natural world and couple resources has gained currency in recent years . . . WWF encountered exactly this 'nexus' phenomenon when [it] prioritised the need to understand and build awareness of the confluence of food, energy and water resources and the implications for development and planning in South Africa." The Food, Energy, Water (FEW) Nexus Report demonstrates the state of the resources at the centre of which is Water.

The challenges presented by the state of both the availability and the quality of water in South Africa constitute serious constraints on the country's development. Pertinent in the extreme for ChemTech is the matter of ongoing deterioration of water quality.

We shall be publishing topical articles on water's role, highlighting solutions to the problems facing us, which are unfortunately becoming ever more critical with the ongoing effects of climate change.

Allied to the water-energy synergy are the subjects of renewable energy production, and the achieving of sustainable energy provision in the country. A report by the Energy Research Centre of the University of Cape Town in 2013 stresses the inextricable link between water use and energy supply.

Future features

Thus our feature articles will hone in on the efforts to find workable solutions for the following challenges, to name but a few:

- A better understanding of the role of energy in the water value chain – pumping, transportation, treatment, desalination, irrigation,
- Ion technology – electrochemical desalination for brackish water
- Water resource toxicity – bacteria (Mission 2017)
- Decentralised water distribution systems: wells, pumps, rainwater collection tanks
- Public-Private Partnerships (PPP)
- Acid Minewater Drainage (AMD)
- Mining and water management (METSI)
- Reclaimed minewater for clean drinking water and treatment of grey water for re-use
- Water risks/water quality concerns such as eutrophication, acidification, sedimentation, salinisation, and microbial pollution
- Water footprints
- Ultraviolet and ozone disinfection
- Non-hazardous chemical treatment
- Ultrafiltration and membrane bioreactors technologies.

As ChemTech is the niche magazine for chemical engineers in sub-Saharan Africa, by advertising in it you are assured of directly reaching decision-makers in all the relevant sectors.

Please support our endeavours to bring these problems and their solutions to light, at the same time ensuring that our contributions, from urban and rural Africa, can be felt around the world.

For more information contact Brenda Karathanasis, advertising manager on tel +27 11 622 4770 or email brendak@crown.co.za.

The Draft Carbon Tax Bill

Part 2 - Allowances and offsets

by Carl Schonborn Pr Eng

In November, 2015, the South African National Treasury published for comment the Draft Carbon Tax Bill. To enable engineers to better understand the Bill, its contents have been edited for brevity and examples included to introduce the structure of the Bill as a commentary. This is a three-part series.

Part 1 (How the tax is calculated based on CO_2 equivalent emissions for stationary and non-stationary/mobile sources) appeared in the February issue. Part 3 - Fugitive emissions, Industrial emissions, will be published next month. From the media statement by the National Treasury of the Publication of the Draft Carbon Tax Bill for public comment on 2 November 2015, the following emerged:

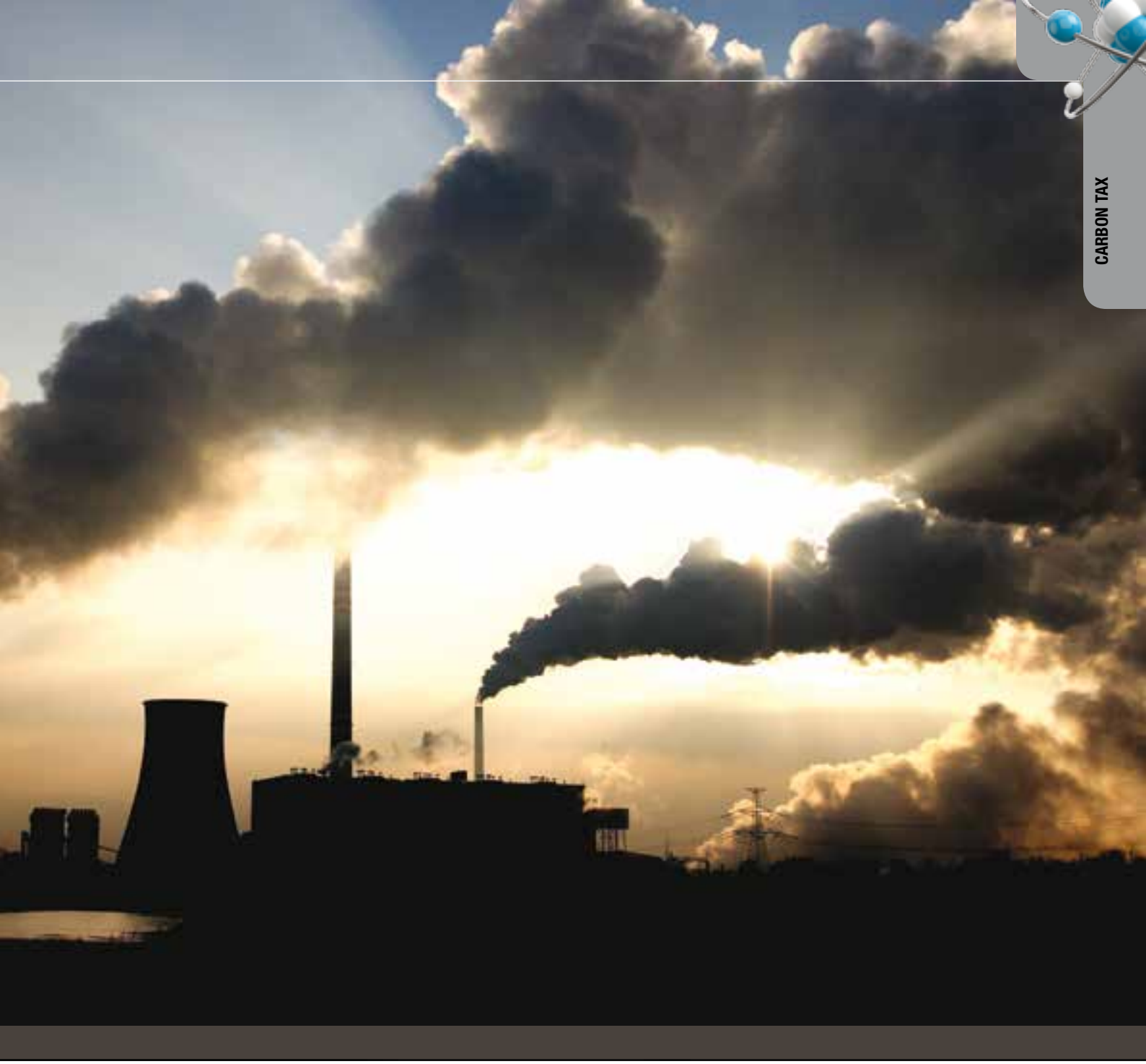
Carbon tax design as contained in the Draft Carbon Tax Bill includes the following features:

A basic 60 % tax-free threshold during the first phase of the carbon tax, from implementation date up to 2020;

- An additional 10 % tax-free allowance for process emissions;
- Additional tax-free allowance for trade exposed sectors of up to 10 %;
- Recognition for early actions and/or efforts to reduce emissions that beat the industry average in the form of a tax-free allowance of up to 5 %;
- A carbon offsets tax-free allowance of 5 to 10 %;
- To recognize to role of carbon budgets, an additional 5 % tax free allowance for companies participating in phase 1 (up to 2020) of the carbon budgeting system;
- The combined effect of all of the above tax-free thresholds will be capped at 95 %; and
- An initial marginal carbon tax rate of R120 per ton CO_2e will apply. However taking into account all of the above tax-free thresholds, the effective carbon tax rate will vary between R6 and R48 per ton CO_2e.

These tax-free exemptions will range between 60 and 95 % of total emissions. This implies that the carbon tax will be imposed on only 5 to 40 % of actual emissions during this period.

The Department of Environmental Affairs (DEA) and the National Treasury have embarked on a process to ensure that the carbon tax is aligned with the proposed carbon budget system. During the first phase of the carbon tax (up to 2020), companies participating in the carbon budgeting process will qualify for an additional tax-free allowance of 5 %.



The tax-free percentage thresholds will remain fixed during the first phase, until 2020. The percentage tax-free thresholds might be reduced thereafter or may be replaced with absolute emission thresholds. Both the tax-free percentage thresholds and their subsequent replacement with absolute emission thresholds will be aligned with the proposed carbon budgets.

From Part 1 of the commentary there were worked examples for Stationary and Non-Stationary/Mobile source emissions.

Until the year 2020 there will be allowances made on the carbon tax liability in accordance with the table Schedule 2, beginning on page 22.

Example 1

As calculated in Part 1 of this article, annual carbon tax liability for Stationary Source, fossil fuel combustion, will be:
27 069 860 CO_2e x R120 = R3 248 383 200

There will be a Section 7, 60 % rebate in the first year.
A Section 12, Carbon Budget allowance of 5 %.
A Section 13, Offset Allowance of 10 %
So payment in first year and until 2020, will be 25 % of R3 248 383 200 = R812 095 800

Example 2

As calculated in Part 1, annual carbon tax liability for Non-Stationary/Mobile source will be:

477 7 tCO_2e x R120 = R57 320

There will be a Section 7, 60 % rebate in the first year.
A Section 12, Carbon Budget allowance of 5 %.
A Section 13, Offset Allowance of 10 %
So payment in first year and until 2020, will be 25 % of R57 320 = R14 330

Sector	Basic tax-free allowance for fossil fuel combustion emissions %	Basic tax- free allowance for process emissions %	Fugitive emissions allowance %	Trade exposure allowance %	Z-factor allowance %	Carbon budget allowance %	Offsets allowance %	Maximum total allowance %
Fuel combustion								
Energy Industries								
Main activity electricity and heat production	60	0	0	0	0	5	10	75
Petroleum refining	60	0	0	10	5	5	10	90
Manufacture of solid fuels & other energy industries	60	0	0	10	5	5	10	90
Manufacturing industries and construction	60	0	0	10	5	5	10	90
Iron and steel	60	0	0	10	5	5	10	90
Non- ferrous metals energy	60	0	0	10	5	5	10	90
Chemicals	60	0	0	10	5	5	10	90
Pulp, paper and print	60	0	0	10	5	5	10	90
Food processing; beverage; tobacco	60	0	0	10	5	5	10	90
Non- metallic minerals	60	0	0	10	5	5	10	90
Transport equipment	60	0	0	10	5	5	10	90
Machinery	60	0	0	10	5	5	10	90
Mining (excluding fuels) and quarrying	60	0	0	10	5	5	10	90
Wood and wood products	60	0	0	10	5	5	10	90
Construction	60	0	0	10	5	5	10	90
Textiles and leather	60	0	0	10	5	5	10	90
Non-specified industry	60	0	0	10	5	5	10	90
Transport								
Civil aviation	60	0	0	10	5	5	10	90
Road transport	60	0	0	10	5	5	10	90
Railways	60	0	0	10	5	5	10	90
Water- borne navigation	60	0	0	10	5	5	10	90
Other transport	60	0	0	10	5	5	10	90
Other Sectors								
Commercial; institutional	60	0	0	10	5	5	10	90
Residential	100	0	0	0	0	0	0	100
Agriculture; forestry; fishing/ Fish farms	60	0	0	10	5	5	10	90
Non- specified								
Stationary	60	0	0	10	5	5	10	90
Mobile	60	0	0	10	5	5	10	90
Multilateral operations	60	0	0	10	5	5	10	90
Fugitive emissions from fuels								
Solid Fuels								
Coal mining and handling	60	0	10	10	5	5	5	95
Oil and natural gas	60	0	10	10	5	5	5	95
Oil								
Venting	60	0	10	10	5	5	5	95
Flaring	60	0	10	10	5	5	5	95
All Other	60	0	10	10	5	5	5	95
Natural Gas	60	0	10	10	5	5	5	95
Other fugitive emissions from Energy Production								
Coal-to- liquids processes	60	0	10	10	5	5	5	95
Gas-to- liquids processes	60	0	10	10	5	5	5	95
Charcoal Production processes	60	0	10	10	5	5	5	95
Coke production	60	0	10	10	5	5	5	95

Sector	Basic tax-free allowance for fossil fuel combustion emissions %	Basic tax- free allowance for process emissions%	Fugitive emissions allowance %	Trade exposure allowance %	Z-factor allowance%	Carbon budget allowance%	Offsets allowance%	Maximum total allowance%
Industrial processes and product use								
Mineral Industry								
Cement production	0	70	0	10	5	5	5	95
Lime Production	0	70	0	10	5	5	5	95
Glass Production	0	70	0	10	5	5	5	95
Other process uses of carbonates	0	60	0	10	5	5	10	90
Chemical industry								
Ammonia production	0	70	0	10	5	5	5	95
Nitric acid production	0	70	0	10	5	5	5	95
Adipic acid production	0	70	0	10	5	5	5	95
Caprolactam, Glyoxal and Glyoxylic acid production	0	70	0	10	5	5	5	95
Carbide production	0	70	0	10	5	5	5	95
Titanium Dioxide production	0	70	0	10	5	5	5	95
Soda ash production	0	70	0	10	5	5	5	95
Petrochemical and Carbon Black production	0	70	0	10	5	5	5	95
Fluoro chemical Production	0	70	0	10	5	5	5	95
Metal Industry								
Iron and steel production	0	70	0	10	5	5	5	95
Ferroalloys production	0	70	0	10	5	5	5	95
Aluminium production	0	60	0	10	5	5	10	90
Magnesium production	0	60	0	10	5	5	10	90
Lead production	0	60	0	10	5	5	10	90
Zinc production	0	60	0	10	5	5	10	90
Non- energy use of fuels and solvent use	0	60		10	5	5	10	90
Electronics Industry	0	60		10	5	5	10	90
Product uses as substitutes for ozone depleting substances	0	60		10	5	5	10	90
Refrigeration and air conditioning	0	60	0	10	5	5	10	90
Foam blowing agents	0	60	0	10	5	5	10	90
Fire protection	0	60	0	10	5	5	10	90
Aerosols	0	60	0	10	5	5	10	90
Solvents	0	60	0	10	5	5	10	90
Other product manufacture and use	0	60	0	10	5	5	10	90
Electrical equipment	0	60	0	10	5	5	10	90
SF6 and PFCs from other product uses	0	60	0	10	5	5	10	90
N_2O from product uses	0	60	0	10	5	5	10	90
Agriculture, forestry and land use								
wwLivestock								
Enteric fermentation	100	0	0	0	0	0	0	100
Manure management	100	0	0	0	0	0	0	100

Sector	Basic tax-free allowance for fossil fuel combustion emissions %	Basic tax- free allowance for process emissions %	Fugitive emissions allowance %	Trade exposure allowance %	Z-factor allowance %	Carbon budget allowance %	Offsets allowance %	Maximum total allowance %
Land								
Forest land	100	0	0	0	0	0	0	100
Cropland	100	0	0	0	0	0	0	100
Grassland	100	0	0	0	0	0		100
Wetlands	100	0	0	0	0	0	0	100
Settlements	100	0	0	0	0	0	0	100
Aggregate sources and non- CO_2 **								
GHG emissions from biomass burning	100	0	0	0	0	0	0	100
Liming	100	0	0	0	0	0	0	100
Urea Application	100	0	0	0	0	0	0	100
Direct nitrous oxide emissions from managed soils	100	0	0	0	0	0	0	100
Indirect nitrous oxide emissions from managed soils	100	0	0	0	0	0	0	100
Indirect nitrous oxide emissions from manure management	100	0	0	0	0	0	0	100
Harvested wood products	100	0	0	0	0	0	0	100
Waste								
Solid waste disposal on land	100	0	0	0	0	0	0	100
Biological treatment of solid waste management	100	0	0	0	0	0	0	100

***This category covers any entity that perceives that it does not fall under any of the categories listed above.*

***Allowances* (numbering in accordance with Draft Carbon Tax Bill)**

Allowance for fossil fuel combustion

7 A taxpayer that conducts an activity that is listed in Schedule 2, below, in the column 'Sector' may receive an allowance of 60 % of the total percentage of greenhouse gas emissions in respect of a tax period in respect of that activity until the year 2020.

Carbon budget allowance

12 A taxpayer that conducts an activity that is listed in Schedule 2 in the column 'Sector', and participates in the carbon budget system during or before the tax period, may receive an additional allowance of 5 % of the total percentage of greenhouse gas emissions in respect of a tax period.

Offset allowance

13 (1) Subject to subsection (2), a taxpayer may reduce the amount in respect of the carbon tax for which the taxpayer is liable in respect of a tax period by utilising carbon offsets as prescribed by the Minister.

(2) The reduction of the liability for the carbon tax allowed in terms of subsection (1) may not exceed so much of the percentage of the total greenhouse gas emissions of a taxpayer in respect of a tax period as is determined by matching the line in the column 'Sector' with the percentage in the corresponding line of the column 'Offsets allowance %' in Schedule 2.

Limitation of allowances

Limitation of sum of allowances

14 A taxpayer may only receive the sum of the allowances contemplated in Part II of the Bill in respect of a tax period to the extent that the sum of those allowances does not exceed 95 % of the total greenhouse gas emissions of that taxpayer in respect of that tax period as determined in terms of the column 'Maximum total allowances %' in Schedule 2.

SCHEDULE 3

(Section 21)(Not included here but can be read in the Draft Carbon Tax Bill)

Word omissions from existing enactments.

Word insertions in existing enactments.

Summary of Comments by the Energy Research Centre (ERC), University of Cape Town, on the Draft Carbon Tax Bill of November 2015

The ERC is pleased to see Treasury is moving from policy to lay a legal basis for the carbon tax and offers these comments in the hope that they may contribute to the implementation of a well- designed and environmentally effective carbon tax.

In general we are of the view that the legislation could benefit from a legal review on general and specific issues, including clarity on objectives, how these can be achieved, precise definitions, administrative simplicity, consistency in principles of operation and placement on elements in the Act and Regulations. Also, considering that the implementation of the tax has already been postponed a number of times, the ERC recommends that intensive work be done ensure that a well-designed tax is implemented from 1 January 2017.

On the specific details of tax, if the tax rate starts as low as has been proposed in the draft Bill, then it should increase every year as previously proposed in Treasury's 2013 carbon tax policy paper. Such an increase would be better dealt with in a schedule in regulations, which itself would be provided for in section 20 of the Bill. Another concerning issue is that existing allowances, together with the new additional allowances in the Bill such as those for carbon budgeting, will reduce the effective tax rates. Carbon budgets will, however, have no regulatory effect in 2016–2020, so allowances for them would only seem warranted once they are in effect. In addition, the exclusion of fugitive emissions seems contrary to the objective of a carbon tax, with no sound basis being provided. Not including GHG emissions from petrol and diesel under any instrument would also ignore a significant and fast-growing sector. We note that the combination of a wide set of allowances, together with deductions for emissions from petrol/diesel and sequestration, allows for instances of R0 tax.

The ERC is also of the view that an enabling provision should be included in the legislation on recycling of revenues, establishing a jobs and competitiveness programme that would ensure a) assistance to poor households, and b) transitional assistance for mitigation by energy-intensive and trade-exposed firms, against agreed plans.

On the objective of the legislation, we recommend that it should be clearly and simply stated. The objective, which should be to reduce GHG emissions, needs to be clearly linked to the legal

mechanisms, with a provision for the assessment of the impact of the legislation being made in the Act. There is also no provision to improve the design of the tax over time in the Bill. The ERC recommends that legislation should be reviewed every five years and provide for the Minister to update regulations more frequently.

Efficient flow measurement using heating jackets

An Endress+Hauser client in the power industry has presented a challenge, measuring the flow of sulphur into the SO_3 plant; the sulphur has to remain in a liquid form at 135 °C to prevent it from cooling, hardening, blocking the tubes and ultimately obstructing the process.

Coal has been the mainstay of electricity generation and plays an important role. In the order to reduce harmful emissions, sulphur trioxide SO_3 is injected into the precipitation inlet flow to change the resistivity of the existing particles and enhance the performance of the electrostatic precipitators. Too much SO_3 will create a higher acid dewpoint and increased probability of cold-end corrosion and acid emission. If there is too little, the electrostatic precipitator's performance will suffer and release increased particulate emissions to the atmosphere.

Measuring the flow of sulphur into the SO_3 plant is therefore integral to the process, as is retaining the optimum temperature. The sulphur flows at extremely high temperatures and the pipelines need to be trace-heated to maintain the fluid properties of the sulphur.

Promass 83F is more than up to the challenge with a process temperature capability of 350 °C, performing at pressures up to 350 bar. In order for the application to work effectively, the sulphur has to remain in a liquid form at 135 °C to prevent it from cooling, hardening, blocking the tubes and ultimately obstructing the process.

However, if the temperature exceeds 150 °C, the viscosity rises and the sulphur does not flow easily. Maintaining the optimum temperature is therefore vital to achieving maximum effectiveness of the process. Heating jackets were recommended as they can be placed over the Promass meter in order to maintain the optimum temperature for sulphur flow.

The process also demanded high accuracy at very low flow rates. Due to Promass 83F zero point accuracy, this was no problem. What's more, in providing a short-tube Promass 83F, the client can clean the meter in the event of a problem. The short-tube design of the sensor is instrumental in keeping the plant operation and maintenance costs to a minimum as there is no longer the necessity to buy a replacement meter every time there is a problem.

For more information contact
Frans van den Berg , Product Manager: Flow, Endress+Hauser on tel: +27 11 262 8000, info@za.endress.com or go to http://bit.ly/246LI7e

How Prei Instrumentation collects data differently and why it matters

Since the 1980s, online condition monitoring software has used the same basic data acquisition scheme: Δ time, Δ rpm, and alarm event capture. But when you look closer, it's a scheme that virtually guarantees you'll miss important data. We decided we could do better – much better.

Online vibration software, by design, does not store everything. If it did, even a modest number of vibration sensors would incur terabytes of data storage per month. The implications of storing everything and moving it over the network infrastructures available in a typical industrial plant quickly render it impractical. Furthermore, sifting through unremitting hours of vibration data to find the 'blip' of interest can be daunting.

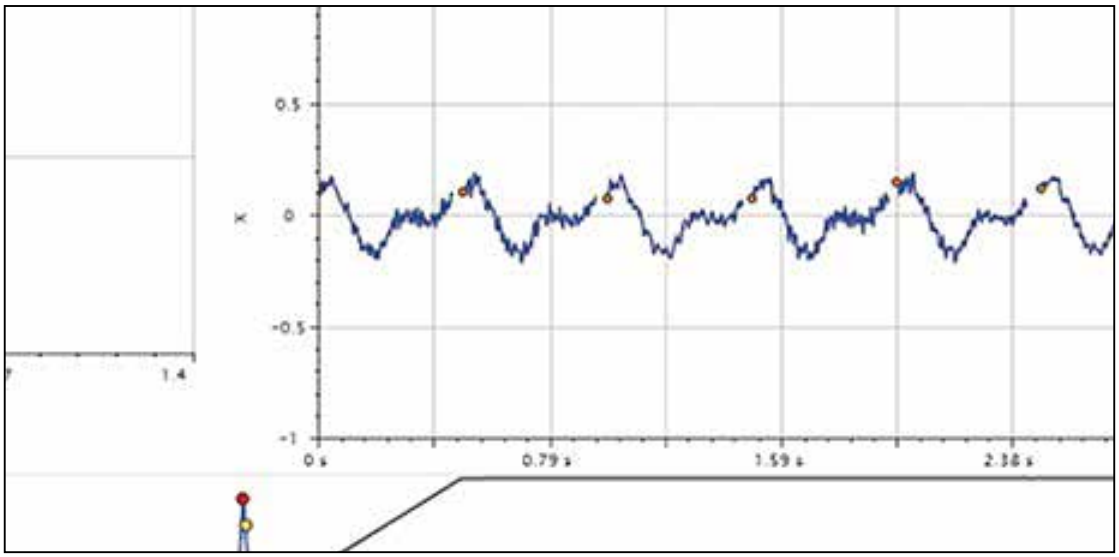
To combat this, the condition monitoring industry would traditionally collect data based on three basic models; periodically through time, with a change in RPM and if an alarm threshold is crossed. For the post mortem analysis for a major event, this method may be sufficient.

Unfortunately, the proverbial 'bump in the night' that comes as a precursor to the major event, does not abide by the rules set in traditional three basic models. It is the precursor events that are crucial to the predictive maintenance analysis and the subsequent avoidance of the major events.

SETPOINT took a completely different approach: "We save data only when it changes." Simple, right? After all, if the data isn't changing, there's no need to save. SETPOINT patented this change detection idea because it encompasses not just trend type data as found in typical histories, but it also encompasses waveform data. We call it 'i-factor™ technology' and it ensures you never miss important data, yet never store uninteresting data that would otherwise clog up your IT infrastructure.

Story by Steve Sabin – Product Manager

For more information
contact Kegan Smith on tel: +27 11 867 5001/7/47; or email:sales@prei.co.za.



SAIChE IChemE NEWS

IChemE
SAIChE IChemE

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website: www.saiche.co.za

SAIChE IChemE Member group news

CPD Course

Topic: Process Engineering Fundamentals for Food, Chemical, Refining & Pharmaceutical Manufacturing
Place: Department of Process Engineering, University of Stellenbosch.
Date: 14 – 15 April 2016

To register for this course, please use the following link on the University's Short Course Website.
Click APPLY in the middle of the page and follow the links.
http://www.shortcourses.sun.ac.za/courses/3962.html

SAIChE IChemE KZN member group news

The SAIChE KZN member group held its regional AGM and dinner on 6 November 2015 at the Riverside Hotel, Durban. This is an annual event organised by the KZN SAIChE committee for its members. The event began with the AGM where the annual report was presented by Chairperson, Simphiwe Mazibuko. The report included feedback on the branch activities for the past year.

The financial report was also presented to members by the treasurer. SAIChE KZN then elected its new committee. The SAIChE KZN branch committee for 2015/2016 consists of: Simphiwe Mazibuko, Zanele Madinane, Maggie Chetty, Nokuthula Danisa, Thokozani Sikhakhane, David Lokhat, Fezile Maphumulo, Ziphathele Chamane and Bavelile Hlongwa.

The keynote address at the subsequent dinner was delivered by Dr Lakesh Maharaj and Ms Karessa Pillay, both from Umgeni Water. The presentation consisted of a concise look at the strategies for water supply in the area, including the potential for desalination.

The winners and participants of the SAIChE KZN branch Research Day, held earlier in the year, also received their awards at the dinner.
We would like to take this opportunity to thank our members for their support.

Written by David Lokhat on behalf of the SAIChE IChemE KZN Members group

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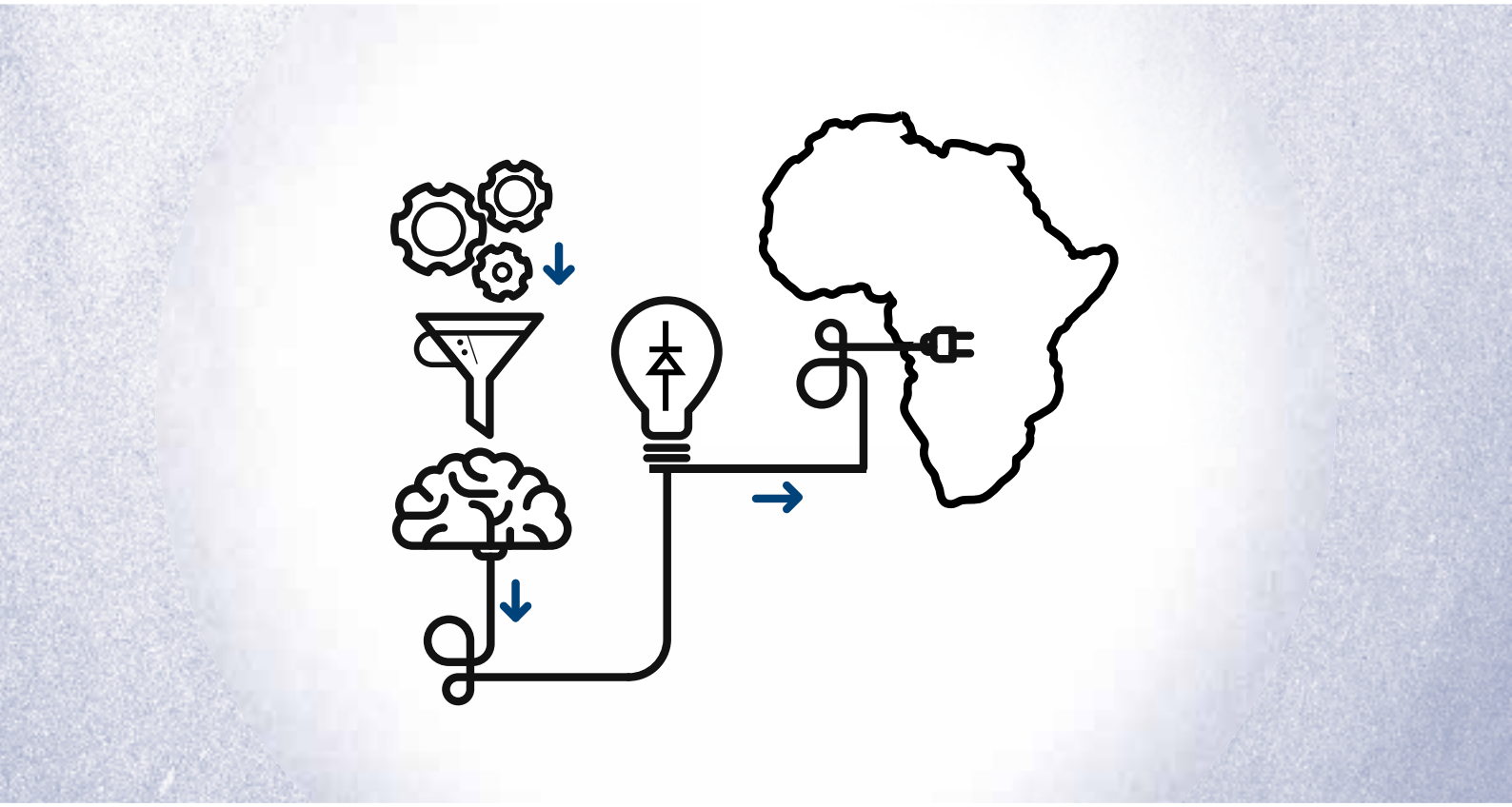
PUBLICATIONS



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Michelle Low, SAIChE Council member, interviewed the UCT Chemical Engineering students who won the 8th Annual SAB Intervarsity Beer Brewing Challenge

The team consisted of the following PhD Chemical Engineering candidates: Brian Willis (team captain 2015), Catherine Edward, Alex Opitz, Bronwyn White, and Dr Robert Huddy who was the academic representative.

From left: SAB Trade Brewer Newlands Brewery, Denis da Silva with University of Cape Town team members; Brian Willis; Catherine Edwards; Alex Opitz; Bronwyn White and Rob Huddy; and SAB Director Supply Chain and Technical, Stanislav Maar

ML: How did you hear about the competition and what is this competition about?
UCT: UCT has been part of the competition since its inception. SAB donated funding to build a microbrewery in 2006, and since then the Postgraduate Chemical Engineering (Chem Eng) have been involved. The competition is about bringing like-minded (mostly postgraduate) students who have a passion for brewing, who want to understand the science, and engineering that backs great beers. It allows the teams to put their brewing skills and acumen up to the test against each other.

ML: How was the UCT team formed?
UCT: Some of the members have now been involved with the team for five years, so we have very good depth and experience. A call is put out at the beginning of each year to new postgraduate Chem Eng students to join the team; we do like to offer the opportunity to the newer students to experience the competition.

The team then runs a few example brews and slowly introduces new students to the process. Brewing is a very time-consuming process, easily taking 5-6 hours on a brew day with an hour prep time before a brew starts, hence we start at 6am on a Saturday morning. This quickly sorts out the dedicated members who will then get chosen to represent UCT at the annual competition.

ML: What was involved for the brewing competition?
UCT: For competition brews, we have to choose a style to brew towards such as a Dunkel, Pilsner or Foreign Extra Stout for example. This requires us to design a recipe from scratch, after which the whole process should appropriately fall within the style.

The style is defined in five categories: aroma, appearance, flavour, mouthfeel, and overall impression, among some additional specifications. The choice of the malts, hops, water and yeast, as well as the brewing process and fermentation schedule all need to be decided upon to create the perfect pint! And then repeated to make sure we are taking our best example of the style!

ML: What brews did you enter and which ones won what?
UCT: We entered beers into every category, namely our Dunkel Lager, Don't Dunkel with My Heart, which won best lager, and best overall beer. For the Winter Warmer category, which required an ABV of 7+%, we made a foreign extra stout. For the cider category we made a pear cider, made from pears from Ceres, and finally a Marula Wit Beer for the speciality category, which required brewing a beer with a South African spin.

ML: Are any of the brews based on research done at UCT?
UCT: Unfortunately, none of this year's brews were directly related to any of our research efforts, however, in the past we have chosen to focus research around yeast work, and its performance, typically offering at least two brewing projects to final year undergraduate students for their dissertation.

ML: What can we expect from you this year?
UCT: Last year we weren't as prepared as we would have liked to be, so it was great to still come off with the win. We are starting off with brews from March, some of which will be set aside for the competition, as the higher alcohol beers need to be matured to improve their flavour.

Continued on page 30

SAB Intervarsity Beer Brewing Challenge

Continued from page 29

So our goal is to be better prepared and correct the faults identified in our beers from last year. Consistency is key, and its what we work towards.

We have now won the over all competition twice and won category awards every year since 2012, and of course the overall win is the goal again!

ML: Any advice for students who are brewing or interested in brewing?

UCT: Brewing takes a lot of time and dedication, but at least there is reward at the end. However, when a beer gets infected and goes sour (it will happen), don't be disheartened. It really does happen to everyone. We have trained microbiologists with us, and it still has happened. What every brewer should work towards is brewing a quality product consistently. That is the real challenge.

Catherine Edward says: "Having the exposure to as many styles as possible is important as it opens your eyes to the various possibilities for brewing as opposed to the typical lager beer."

Connect with team Brewing UCT!

Facebook: https://www.facebook.com/groups/BrewingUCT/ Email: brewing@myuct.ac.za

Any other link: http://www.sabstories.co.za/beer-culture/university-of-cape-town-wins-2015-sab-intervarsity-beer-brewing-championship/?age-verified=83bc5eea8d

http://www.timeslive.co.za/lifestyle/2015/08/23/UCT-is-country's-top-beer-brewing-varsity

Fundamentals of Process Safety Management' IChemE course 2016

The Institution of Chemical Engineers (IChemE) "Fundamentals of Process Safety Management" course, (PSM), is being held at the Birchwood Hotel & OR Tambo conference Centre, Boksburg, from the 9-13th May 2016. The proceedings will cover the entire five-day UK IChemE course and is approved by IChemE.

Course leaders are Rod Prior, a chemical engineer with over 30 years of experience in process industries, including production, commissioning and health and safety management; and Nigel Coni, who has over 40 years' experience in the chemical industry, in design, project, production and consulting positions.

The course is aimed at process plant management, supervisors, engineers, designers and safety experts. The course will cover, inter alia, a model for PSM and basic hazard science, performance measurement and learning from accidents, design safety, legal framework, management of change, human factors and safety culture, mitigation and emergency responses and much more. A comprehensive course manual will be provided.

For further information and/or queries contact

Rod Prior: SHExcellence cc.

Cell: 082 554 0010.

MAY

- Water treatment
- Corrosion and coatings
- Minerals processing and metallurgy
- Renewables

JUNE

- Waste management
- Separation and filtration
- Petrochemicals
- Supply chain management

Low profile bulk bag filler pivots fill head to operator

A new Rear-Post Bulk Bag Filler features a patented Swing-Down™ fill head that pivots to the operator at floor level for safe, ergonomic spout connections, and a low-profile loading deck that allows removal of filled bags using a pallet jack.

The cantilevered fill head pivots downward to a vertical orientation that places the inflatable bag spout seal, inflator button, and four bag loop latches within an arm's length of an operator standing on the plant floor, eliminating the need to climb steps, strain or risk injury associated with overhead connections to conventional fill heads.

Once the operator connects the bag straps and activates the inflatable bag spout collar, the filler automatically pivots the fill head to horizontal, inflates the bag to remove creases, and activates a flow control inlet valve or feed conveyor. As load cells register the gain in weight, the controller raises and vibrates the loading deck at programmed intervals to densify material and promote flow into bottom corners of the bag. Once the bag reaches its target weight, the controller automatically stops the flow of incoming material, deflates the bag spout collar and releases the bag straps, allowing the filled bag to be removed using a pallet jack or forklift.

A patented mechanism automatically resets the latch after releasing the bag loops, and repositions it as the fill head pivots into a vertical position, enabling the latch to receive bag loops inserted by an operator and to relatch automatically.

The filler is constructed of carbon steel with a durable industrial coating, with product contact surfaces of stainless steel finished to sanitary or industrial standards, and is offered with mechanical or pneumatic conveyors to source material from upstream process equipment or storage vessels.

Also offered are patented Twin-Centrepost™ bulk bag fillers for low capacity applications and/or compliance with USDA Dairy standards.

In addition, the company manufactures bulk bag dischargers, bulk bag conditioners, flexible screw conveyors, tubular cable conveyors, pneumatic conveying systems, bag dump stations, drum/box/container tippers, weigh batching systems and engineered plant-wide bulk handling systems with automated controls.`

For more information contact
Flexicon Africa on tel:+27 (0)41 453 1871; email: sales@flexicon.co.za; or go to www.flexicon.co.za.

AZ-Armaturen South Africa continues to grow

During these tough economic times people tend to cut back and down size. This is not the case for AZ-Armaturen South Africa. The company has been growing and investing continuously during the last few years and has increased its market share in the stagnating valve market. AZ South Africa has invested further and introduced a new CNC (Computerized Numerical Control) machine into the production.

The new CNC lathe with live tooling (multiple axes for milling) and latest state of the art technology allows AZ-Armaturen to increase productivity, flexibility and improve quality with their plug valves. This has also furthered AZ staff's education on world class technology. AZ-Armaturen South Africa once again is a true ambassador for their moto "Your Partner for Highest Demands".

For more information contact on tel: +27 (0) 11 397 3665; email: info@az-armaturen.co.za

New surface finish standard for the GEMÜ 480 Victoria® butterfly valve series

GEMÜ, a company that specializes in the manufacture of high-quality valves, measurement and control systems, has modified the coating on the valve bodies in its series of concentric, soft-seated GEMÜ 480 Victoria® butterfly valves. In line with the new standard, a 250 µm epoxy coating will be used from now on. The screws and bolts for fixing the actuators are manufactured from stainless steel. As a result of this and other measures, such as optimized workpiece pre-treatment before the coating process itself, all product configurations now comply with the requirements of the C5M, medium-durability classification as stipulated in DIN EN ISO 12944.

The improved coating means that the butterfly valve can now also be used in coastal and offshore areas, as well as in buildings with permanent condensation and pollution. At the same time, compliance with this standard affords the customer a certain degree of certainty when it comes to planning, as the service life of the valve is more predictable.

"We have incredibly strict requirements when it comes to the quality of our products, which is why we are continually working to improve them even further than we have to date. The new coating for the valve bodies in the GEMÜ 480 Victoria® series means that our customers can now use the butterfly valves for an even wider range of applications," says Joachim Brien, Head of the Technical Department at GEMÜ.

For more information contact Claudio Darpin on tel: +27 11 462 7795; email:
claudio.darpin@gemue.co.za; or go to www.gemu-group.com.

The Budget Speech and its impact on energy efficiency

SAEE President, Karel Steyn, comments.

Everyone waited with bated breath for the Minister of Finances to present his budget speech, expecting the worst but hoping for the best. Many aspects were covered with government efficacy being highlighted as a key focus area. Let me not delve into matters with which economists and accountants can do much better, but focus on one of the important areas mentioned which has a direct impact on energy consumers and those of us active in the energy market.

The minister announced that the fuel levy will increase by 30 c/litre, meaning that the total fuel levy on petrol will amount to R4,43/litre or 36,5 % of pump price and the total fuel levy on diesel will amount to R4,28/litre or 45,4% of pump price.

With the mentioned in mind, the following may be considered:

1 What will happen to the overall fuel price when the oil price recovers to its former record levels? (and it will; the IEA has already issued a warning to this effect), and,
2 The impact of the additional 30 c/litre levy on energy efficiency considerations.

Consider that the highest ever crude oil price was $143 in June 2008. The current diesel price is R9,48 and the crude oil price is only $32. The diesel price with the 30 c levy included would then become R9,78. The relationship between the crude oil price and the fuel price should cause the fuel price to increase or decrease in relation to the changing crude oil price. Consider then what would happen to the fuel price if the crude oil price returned to its highest level ever ($143)? A direct extrapolation points to a diesel fuel price of about R43/litre. Reality is, however, usually much different than predictions. It does not really matter either as a lot can happen between now and then. However, needless to say that fuel will become that much more expensive in future. Something which we all have to include in our future planning and budgets.

Secondly, what will the impact of the additional fuel levy be? The fuel price without any levies would be R8,30 for petrol and R5,35 for diesel per litre. Private and business consumers of diesel or petrol know how many litres of fuel they use in a typical month or year and it would therefore be easy for them to calculate the impact the levies raised would have on their budgets and operational costs. However, there is also a different perspective. What would the value be of the existing section 12L tax incentive be if all these additional levies are included into the calculations for an energy efficiency project which will save fuel?

Diesel is the fuel generally used for transportation, in industrial or commercial applications and the same is therefore used for calculating its impacts. In an article a few years back I highlighted the total value of the 12L incentive with an example where 1 000 000 litres of diesel is saved which would also be equivalent to almost a 1 000 000 kWh of savings (the kWh equivalent being depended on the energy content). With the section 12L calculator, the overall value of the incentive after tax, before adding any of the levies, is calculated to be R2 660 000. Yes, its correct; R2,7 m in addition to the savings in the diesel bill! When all the levies are included and the same amount and type of fuel is saved then the section 12L incentive value would be ... (Take a guess; would it be more or less?)

Either! The incentive amount stays the same! The levies or cost of energy have no impact on the 12L tax incentive amount which the business tax payer will receive for verified energy savings achieved. This is because the price of the energy source itself has no relation to the incentive. The tax incentive is 95 c per kWh (before tax) saved, without considering the actual cost of the applicable energy source. However, the energy source type, with its applicable energy content, and the amount of energy saved, has a direct relation and impact on the tax incentive benefit.

This means that the levy of 30 c/litre or the total levy of R4,28/litre for diesel fuel has absolutely no bearing whatsoever on the section 12L incentive benefit! However it will have an impact on the business' total net profit after tax because the increased costs cannot all always be moved to the consumer! The future price of fuel will hurt every South African; except if we could manage to move away from diesel (or petrol and paraffin) or use less.

SUDOKU NO. 112

Complete the grid so that every row across, every column down and every 3x3 box is filled with the numbers 1 to 9. That's all there is to it! No mathematics are involved. The grid has numbers, but nothing has to add up to anything else. You solve the puzzle with reasoning and logic. For an introduction to Sudoku see http://en.wikipedia.org/wiki/Sudoku

5			6				1	
			9		5	4	6	3
						2		
	5	7					9	
	6		1				4	
	7		3					
					8		5	9
6		3		4	9	1		

Solution for SUDOKU 111

4	5	7	6	8	1	9	3	2
3	9	6	7	5	2	4	1	8
8	1	2	4	9	3	6	7	5
7	8	9	3	6	4	5	2	1
1	3	4	9	2	5	8	6	7
2	6	5	1	7	8	3	9	4
6	4	8	2	1	9	7	5	3
5	7	1	8	3	6	2	4	9
9	2	3	5	4	7	1	8	6

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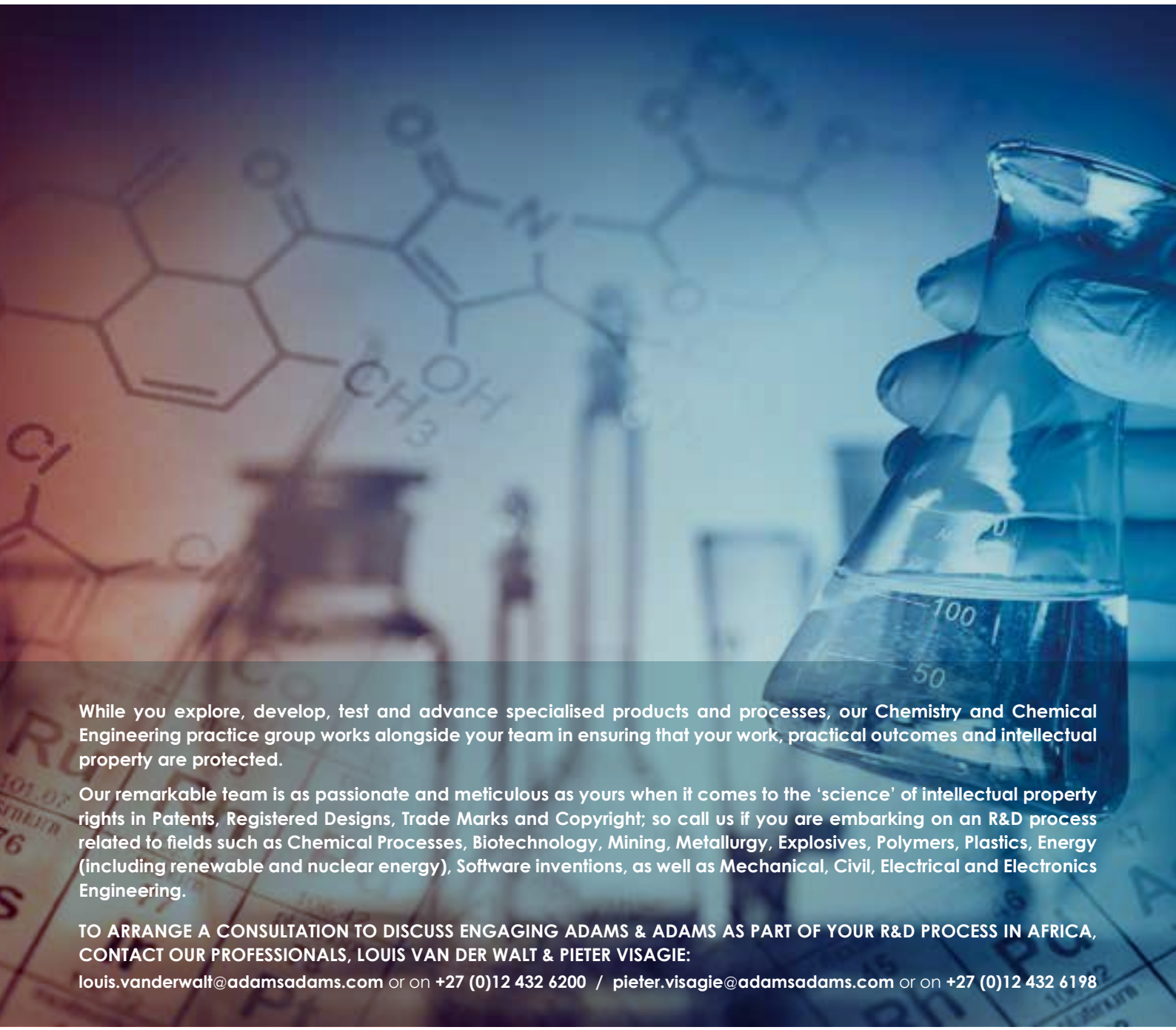

While you explore, develop, test and advance specialised products and processes, our Chemistry and Chemical Engineering practice group works alongside your team in ensuring that your work, practical outcomes and intellectual property are protected.

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Adams & Adams

CONVEY

FLEXI-DISC™ Tubular Cable Conveyors gently slide fragile foods and non-foods through smooth stainless steel tubing routed horizontally, vertically or at any angle, over short or long distances, dust-free. Single or multiple inlets and outlets.

DUMP

FLEXICON™ Manual Dumping Stations allow dust-free dumping of bulk material from bags and other containers. Automatic reverse-pulse filter cleaning allows continuous, efficient operation. Available with integral bag compactors for total dust containment.

UNLOAD

BULK-OUT™ Bulk Bag Dischargers unload free- and non-free-flowing solids from bulk bags automatically. Allows untying, discharging, retying and collapsing of bulk bags—all dust-free. Available with weigh batching controls.

USDA

CONDITION

BLOCK-BUSTER™ Bulk Bag Conditioners loosen materials that have solidified during storage and shipment. Variable height turntable positions bag for hydraulic rams with contoured conditioning plates to press bag on all sides at all heights.

FILL

SWING-DOWN™, REAR-POST and TWIN-CENTREPOST™ Bulk Bag Fillers can fill one bulk bag per week or 20 per hour at the lowest cost per bag. Numerous performance options. Available to industrial or sanitary standards.

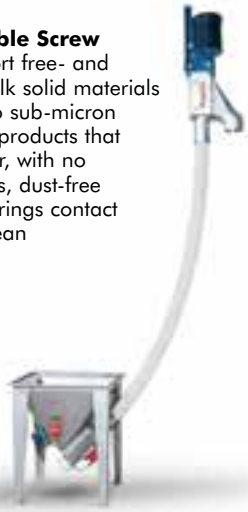
USDA

CONVEY

FLEXICON™ Flexible Screw Conveyors transport free- and non-free-flowing bulk solid materials from large pellets to sub-micron powders, including products that pack, cake or smear, with no separation of blends, dust-free at low cost. No bearings contact material. Easy to clean quickly, thoroughly.

USDA

3-A



CONVEY

PNEUMATI-CON™ Pneumatic Conveying Systems move a broad range of bulk materials over short or long distances, between single or multiple inlet and discharge points in low to high capacities. Available as dilute-phase vacuum or positive pressure systems, fully integrated with your process.

TIP

TIP-TITE™ Container Tippers dump bulk material from drums (shown), boxes or other containers into vessels up to 3 metres high. Dust-tight (shown) or open chute models improve efficiency and safety of an age-old task.

SUCCEED

The FLEXICON™ Lifetime Performance Guarantee* assures you of a successful result, whether you purchase one piece of equipment or an engineered, automated plant-wide system. From initial testing in large-scale laboratories, to single-source project management, to after-sale support by a worldwide network of factory experts, you can trust your process—and your reputation—to Flexicon.

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