PCiC energy
MIDDLE EAST

8th PCIC MIDDLE EAST ANNUAL ELECTRICAL AND AUTOMATION KNOWLEDGE SHARING EVENT

PCIC.ENERGY

15 & 16 NOVEMBER 2022
AL KHOBAR - KINGDOM OF SAUDI ARABIA

IN COLLABORATION WITH IEEE INDUSTRY APPLICATIONS SOCIETY SAUDI ARABIA SECTION

IAS IEEE INDUSTRY APPLICATIONS SOCIETY Linking Research to Practice

IEEE SAUDI ARABIA SECTION

ELECTRICAL AND INSTRUMENTATION APPLICATIONS AND AUTOMATION

PROGRAM

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Conference Site

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Greetings from the Technical Committee and Local Organizing Committee

Dear 2022 PCIC energy Middle East Attendees,

On behalf of the PCIC energy conferences, it is my pleasure to welcome all of the industry experts, peers, and especially to the future of our industry - the young engineers, to the 8th Annual PCIC energy Middle East.

The objective for this conference is to provide a professional development forum where Electrical and Automation Engineers meet to **i**nteract on **D**igitization, **E**lectrical and **A**utomation **S**olutions in the Oil, Gas, Petrochemical and Chemical Industry, sharing "**iDEAS**", knowledge, best practices, lessons-learned, new technologies and industry standards to improve operational safety, efficiency and to provide professional development opportunities for all attendees.

2022 is a year of many "firsts" for PCIC energy Middle East – thank you to our volunteers, their employers, and to our sponsoring companies:

- First year to host the conference in Saudi Arabia
- First year with the affiliation between PCIC Middle East, PCIC Europe and IEEE IAS (CH08350 - Saudi Arabia Section Chapter, IA34)
- First year participation for several sponsor companies, including Title Sponsors

PCIC energy Middle East is a non-profit organization that is managed and organized by industry-based volunteers. Thank you to each of the individuals that have dedicated their nights, weekends and countless hours to organize the technical content, support the authors, recruit sponsors and attendees and organize the conference itself.

Thank you to each attendee, it is your interaction, interest and expertise that create the best knowledge-sharing event in our industry.

We look forward to an excellent conference with veteran industry experts, young engineers, end-users, manufacturers, service providers, academia, standards organizations, certification agencies and regulatory bodies from different countries around the world, sharing new and exciting knowledge during 2022 PCIC energy Middle East.

On behalf of the PCIC energy Middle East Committee, we look forward to supporting your professional development and wish you a most successful conference.

Florent Baldeck
Chair, 2022 PCIC energy Middle East

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SCHEDULE AT A GLANCE (AS OF TUESDAY 8th NOVEMBER)

Monday 14th November 2022
16:30 – 20:00: registration is open

Tuesday 15th November 2022

Time	Room 1: Aldana Hall				Room 2: Al Mawad 4&5
7:15	Registration is open				
8:00	Welcome address and safety notices *(Aldana Hall)*				
8:15	Keynote speaker: IEEE Saudi Arabia Section Head *(Aldana Hall)*				
TOPICS					
Time	Sustainability	Digitalization	Technology & Innovation	Safety	Maintenance & Reliability
8:30	Tutorial 1: SA22_72 - Optimized Motor and Starter Selection for Large Electric Drive Systems / Luiz Santos (WEG) *(Aldana Hall)*				
10:00	Break & Sponsors tables				
10:30	Tutorial 2: SA22_63 - Fundamentals of Partial Discharges in Medium Voltage Cables / Rene Hummel (Imcorp) *(Aldana Hall)*				
12:00	Prayer, Lunch & Sponsors tables				
13:30	Paper 1: SA22_14 - Sodium Nickel Battery Field Performance Evaluation in Extreme Environment / Hossam Aldossary (Saudi Aramco)				Paper 2: SA22_35 - Innovative Variable Speed Systems using Induction Motor for Gas Compression / Lionel Durantay (GE)
14:15	Paper 3: SA22_34 - Wind Power and Battery Energy Storage System for Secondary Frequency Regulation / Salem Alshahrani (King Fahd University)				Paper 4: SA22_24 - Bus Differential Protection System Malfunction / Pulak Pal (Petrokemya)
15:00	Prayer, Coffee break and Sponsors tables				
15:30	Paper 5: SA22_65 - CO2 reduction by turbine replacement with Electrical High-Speed Drive Systems / Jeremy Andrews (Siemens)				Paper 6: SA22_52 - Installing an OFF-grid solar Photovoltaic (PV) System / Barjas Dossary (Saudi Aramco)
16:15	Paper 7: SA22_64 - Digitalization of Elect Infrastructure, Essential steps towards Implementation / John Hope (Exertherm)				Paper 8: SA22_23 - Spurious tripping of motor protection relays / Pal Pulak (Petrokemya)
17:00	End of the day				

PCiC energy MIDDLE EAST

Wednesday 16th November 2022

Time	Room 1: Aldana Hall			Room 2: Al Mawad 4&5	
7:15	Registration is open				
	TOPICS				
Time	Sustainability	Digitalization	Technology & Innovation	Safety	Maintenance & Reliability
8:00	Tutorial 3: SA22_71 - Arc-Flash Hazards and Mitigations in Metal-clad Switchgear / Rajkumar Swaminathan (SEL) *(Aldana Hall)*			Paper 9: SA22_62 - Commissioning Partial Discharge Tests according to IEC/IEEE of MV Cables – Rene Hummel (Imcorp)	
8:45				Paper 10: SA22_74 - Achieving operational excellence in LV systems through the application of safe, efficient and intelligent solutions – Mohamed Samy El-Hadad (Eaton Arabia)	
9:30	Break & Sponsors tables				
10:00	Paper 11: SA22_61 - New non-metallic cable support systems for harsh environments applications in ex zones / Albert Casas (Unex)			Paper 12: SA22_66 - Electrical Voltage Dip Impact Mitigation / Mohammed Ashraf Ali (Sabic)	
10:45	Paper 13: SA22_31 - Welcome on the digitalization route / Jean Guilhem (2B1st Consulting)			Paper 14: SA22_40 - 34.5-kV Cable Failure / Mohammed Balhaddad (SAFCO)	
11:30	Prayer, Lunch & Sponsors tables				
13:00	Paper 15: SA22_70 - Implications of IEEE-1584-2018 on Standard Arc Flash Mitigation Schemes / Cory Helfrich (Saudi Aramco)			Paper 16: SA22_30 - Maintenance and obsolescence management of Protection relays / Majdi Alfaraj (Sabic)	
13:45	Paper 17: SA22_ 67 - Supporting decarbonization – an introduction to electro-mechanical ASD / Wissam Moubarak (Voith)			Paper 18: SA22_73 - Process Electrification and application of net zero power hub solution / Shailesh Chetty (Schneider Electric)	
14:30	Prayer, Coffee break and Sponsors tables				
15:00	Paper 19: SA22_53 - Improving arc flash safety of Motor Predictive Maintenance / Mustafa Al-Ramadhan (Saudi Aramco)			Paper 20: SA22_60 - Rotor critical speed of vertical motor excited by the line frequency / Lucas Selonke Klaas (WEG)	
15:45	Paper 21: SA22_68 – Significance of Touch Voltage & Loop Impedance in Saudi Building Code & IEC / Chirantan Gupta (Sabic)			Paper 22: SA22_69 - Field Development Power Demand Optimization amidst Subsurface Uncertainties / Satish Chandra Kurapati (Saudi Aramco)	
16:30	Closing *(Aldana Hall)*				

PCIC energy MIDDLE EAST

The following papers will be presented at the 8th PCIC energy Middle East 2022 – Al Khobar

Réf.	Title	Presenters
SA22_14	**Sodium Nickel Battery Field Performance Evaluation in Extreme Environment** The paper will discuss successful pilot conducted on Sodium Nickel battery technology. The purpose of this technology is to address the following battery system challenges: harsh environments, maintenance requirements, and highCAPEX and OPEX costs. Piloting methodology used to assess the battery's electrical properties over a period of 14 months will be discussed. Furthermore, captured performance metrics during the piloting period likecharge/discharge curves, ambient temperature during summer and winter in KSA, battery efficiency and the cool down/warm up behavior of the battery will be presented. During piloting, the battery was subjected to two summers and one winter, where the average ambient temperature throughout the piloting period was around 42°C and the peak was 62.5°C. The high temperature tolerance and sealed construction of the battery makes it an optimal solution to address the challenging environment in highly corrosive remote onshore, offshore, and indoor locations without HVAC. Finally, a brief economic analysis of utilizing Sodium Nickel battery technology in industrial backup and off-grid solar applications will be shown.	Hossam Aldossary (Saudi Aramco)
SA22_23	**Spurious tripping of motor protection relays** After being in service for 6 to 12 years, motor protection relays often develop a problem of reading current falsely and spurious tripping due to hardware issues. This problem was observed in Petrokemya North in Saudi Arabia during a plant turnaround which could have delayed the plant startup and caused production loss over 18 Million USD as the number of relays with this problem by far exceeded the number of spare relays available. Some relays read current sporadically when the motor is OFF and tripped on number of starts per hour function and some read current continuously when the motor is OFF and tripped on locked rotor function as soon as the motor was started. The paper examines these problems in details and provides a solution methodology which was successfully implemented in Petrokemya North involving upgrading the relay firmware, configuring and programming of the spare switch facility of the relay in a special way and making the necessary hardware changes in the external wiring of the relay to ensure that the opening of the contactor is also included as a condition for the relay to record a motor start.	Pulak Pal (Petrokemya)

Réf.	Title	Presenters
SA22_24	**Bus Differential Protection System Malfunction** Bus differential protection system malfunction can result in severe consequences. Petrokemya North in Saudi Arabia had experienced a major electrical outage where all the plants were forced to shut down causing a production loss above 14 Million USD. The paper deals with the cause, which is, bus differential protection system malfunction due to transient CT saturation during transformer inrush and the solution to the problem. Transformer inrush current contains DC offset and unipolar half wave current. These factors along with residual flux cause transient CT saturation which occurs at much lower value of primary current than the saturation point of a CT. CT saturation causes erroneous CT output which gives rise to differential current in the relay causing a trip when there is no fault inside the protection zone. From the oscillographic fault records of the relay, CT saturation was confirmed by observing the points of rise of restraint and differential currents. To resolve the problem, bus differential relays programmed with an advanced algorithm to detect CT saturation based on the above criteria, and prevent spurious tripping were utilized.	Pulak Pal (Petrokemya)
SA22_30	**Maintenance and obsolescence management of Protection relays** Protection relays are critical element in electrical systems. Their availability and reliability are so essential for plants productions and safety. The reliability of design and life cycle of modern electronic relays are challenge for the essential service. If protection relays are obsolete without replacement plan or preservation is not adequate then availability of critical device will have high impact to plant safety and production if they are needed for replacement. The User is presenting his own best practice for maintenance of electronic relays to ensure continues operation and high reliability. The best practice maintain the necessary minimum practice to ensure relays healthiness using relays smart feature while considering maintenance budget limitation. Obsolescence management and proactively planning is good practice to eliminate capital budget impact. It is also advantage for expert resource utilization; hence, resource is planned and trained accordingly. Presentation will explain the proactive approach to define and replace an aged electronic relays with no impact in plant production or safety.	Majdi Alfaraj (Sabic)

Réf.	Title	Presenters
SA22_31	**Welcome on the digitalization route** Digital technologies are today a trend around the planet and across industries. This paper ambitions to go further than the smoke screen and Wahoo effect of digital technologies to dive in the details of applicable use cases in the petroleum and chemical industries. By explaining and analyzing concrete examples of digital solutions, the goal is to present digital as a toolbox enabling better operations. Our intention is first to explain some wording and concepts gravitating around digital to settle a common ground for discussion. Next, the goal will be to explore the technologies underneath this digital evolution. The second part will start by defining the industrie 4.0 prerequires of a successful digital transition for End-Users. Then we will illustrate this technological evolution with the TOP 50 examples of digital use cases in the petroleum and chemical industry. These use cases will be developed, following this standardized structure: • Cybersecurity • Health, Safety and Environment (HSE) • Asset Applications – Digital Twin • Process Applications – Digital Twin • Augmented Operator • Data Operating System • Connectivity • Data Capture	Jean Guilhem (2B1st Consulting)
SA22_34	**Wind Power and Battery Energy Storage System for Secondary Frequency Regulation** The advent of battery energy storage system (BESS) to power systems introduced many ancillary services that make use of fast response of batteries. Frequency control is one of the most important applications that aid stabilizing electric networks. Secondary frequency control is one type of frequency control that uses the BESS to supply/absorb net power to bring the frequency deviation to its working limits. Renewable energy sources increasingly contribute towards utilization in microgrids for ancillary services, frequency control for instance. The frequency deviation anomaly is more prominent in case of adopting renewable energy sources, and a 30 MW wind power source is considered in this study along with the selected network in Saudi Arabia for analyzing the proper sizing of the BESS.	Salem Alshahrani (King Fahd University)

Réf.	Title	Presenters
SA22_35	**Innovative Variable Speed Systems using Induction Motor for Gas Compression** During the last 30 years, there has been a significant evolution and innovation of electric driven compressors in replacement of steam or gas turbines because of the gas monetization, the process flexibility and the reduction of greenhouse gas emissions. Technology trends are highlighted in this paper up to 120MW. This first part of this paper describes the different technologies of motors with a special focus on the squirrel cage induction motor. The second part introduces and reviews the most powerful and reliable architectures of Voltage Source Inverters and Active Front End Rectifiers Drives in replacement of Load Commutated Inverters, especially for improvement of the grid. Finally, the third part focuses on the architectures of electric compression trains in comparison to conventional trains for LNG, Off-shore and Downstream applications covering standalone and integrated motor-compressor systems, highlighting the advantages in term of CAPEX and OPEX for the end-user.	Lionel Durantay (GE)
SA22_40	**34.5-kV Cable Failure** Most of the industries are still using underground cables in order to supply power to their facilities. These industries remain much concerned about the design, manufacturing and installation of the cables due to their high initial cost and difficulties for troubleshooting. In general, improper cable installation, exposure to water, acidic & other soil contaminants, improper end terminations/splicing are the major concern for the cable outages. This paper is to investigate a real cases of 34.5-kV underground cable failures in one of the plant which led to plant interruptions. These cables were installed in Yr. 2015 and commissioned in Mar. 2017. Since commissioning, we encountered 03 major failures, which caused plant interruptions and put the production in risk.	Mohammed Balhaddad (SAFCO)
SA22_52	**Installing an OFF-grid solar Photovoltaic (PV) System** North Ghawar Gas Producing Department is currently working to pilot installing OFF-grid solar Photovoltaic (PV) system with storage battery bank in gas well UTMN-1954. The main objective of this installation is to maximize hydrocarbon production by utilizing reliable and the most economical power supply systems to Saudi Aramco Southern Area Unconventional Gas wells Facilities. This is the first system deployment for Saudi Aramco Southern Area gas well application to evaluate system reliability, operability, maintainability & to enhance the system further. The technical paper will discuss the following items: Value proposition comparison between conventional and Renewable power supplies. Economic Analysis for supplying power to gas well through solar (PV) system. Solar (PV) system specification such as (Panel Capacity, Storage battery capacity, type of cooling system, etc). The system design feature for operational reliability and security. Energy efficiency measures that taken to reduce both plant area and deployment cost.	Barjas Dossary (Saudi Aramco)

Réf.	Title	Presenters
SA22_53	**Improving arch flash safety of Motor Predictive Maintenance** Online motor condition test is performed to track important health indicators such as motor current signature analysis. The test requires connecting voltage and current leads at the substation, which requires opening the front covers of the motor starter, imposing arc flash hazard. Arc flash safety has been raised recently as a major concern in industrial facilities and NFPA 70E has established guidelines for risk mitigation. One solution is utilizing motor terminal access ports (MTAP). MTAP have a plug mounted outside the cubicle front cover and permanent connections inside the cubicle. It allows connecting the motor condition tester through the plug without opening the front cover. MTAP was installed and tested on one of Saudi Aramco oil Terminal important motors as a trial. The results were compared with the previous procedure and proven satisfactory. Motor terminal access ports were ordered for other motors, resulting in improved arc flash safety.	Mustafa Al-Ramadhan (Saudi Aramco)
SA22_60	**Rotor critical speed of vertical motor excited by the line Frequency** Vertical motors have peculiarities in relation to the calculation of critical rotation. The lower bearing, taken as a guide, has uncertain load, which results in a high range in bearing rigidity. The upper bearing, on the other hand, has a well-defined load; however, the bearing support stiffness varies according to the structure as flange and frame. In this case, of article, the test of vertical motor that presented high vibration will be presented. The features of the motor are 04 poles, 60Hz, 500 kW, 2300 V. The size of motor is: 2066 mm high, 800 mm diameter and total mass around 3.300 kg. After evaluation during test plus numerical analysis and rotor dynamic analysis, it was found that this was a critical rotor frequency excited by the line frequency. In resume, the mechanical spinning is 30 Hz and the line frequency is 60 Hz, so the motor present high vibration at two times. Besides the literature recommend the clearance of critical rotation in two times, this case is very particular because it is a vertical motor. After modifying the shaft and moving away from the critical rotation in relation to the line frequency, the motor was released with low vibration readings	Lucas Selonke Klaas (WEG)
SA22_61	**New non-metallic cable support systems for harsh environments applications in ex zones** Together with OPEX reduction, one of the trends for future developments - including those offshore and harsh environments- is for modular construction minimizing site assembly. Size, weight and availability of complete range of fittings are key factors for modulator construction, and all elements are considered including cable support systems such as cable trays and ladders. This paper will explore the use of non-metallic cable support systems, particularly for harsh environmental conditions with high corrosion levels. Work done to determine the acceptability, according to IEC 60079-32-1, for use of new non-metallic cable support systems in hazardous areas will be presented and compared with the use of traditional metallic and non-metallic cable support systems. Practical measures for mitigation of issues of electromagnetic compatibility will also be addressed.	Albert Casas (Unex)

Réf.	Title	Presenters
SA22_62	**Commissioning Partial Discharge Tests according to IEC/IEEE of MV Cables** When it comes to commissioning tests of Medium Voltage Cables, Asset Managers must chose from a variety of different tests in the market. Many common cable system commissioning tests are not according to the IEC/IEEE standards and provide little or no certainty of future performance. This endangers the reliability and longevity of the cables systems and the whole MV network, as failing MV cables in service are creating transients, that can damage other electrical components as well. One of the most effective dielectric tests performed in the factory and the field on solid-dielectric cable system components is the off-line 50/60Hz Partial Discharge (PD) test. When performed as described in the IEC/IEEE standards, it adds huge values to the owner of the cable system. Collected data and test experience of over 200,000 cable system tests will demonstrate the significant improvement in cable system reliability performance that can be achieved using this approach in the field.	Rene Hummel (Imcorp)
SA22_64	**Digitalization of Elect Infrastructure, Essential steps towards Implementation** The adoption of condition monitoring in electrical infrastructure has been relatively slow with periodic inspections continuing to be commonly used. This has significant disadvantages which this Paper will discuss. Digitization (IIOT) and its accelerating global adoption provide the ability to analyze condition data, enabling equipment to be operated at maximum efficiency. The tangible benefits will be identified. We will examine and discuss how simple steps can be initially implemented, providing immediate OPEX savings, and increased fault detection, which can be easily integrated into front-end-software platforms. We will identify why it is essential to select appropriate sensor technology for the appliance of installation within electrical equipment; why getting this important decision wrong can result in huge lifetime cost increases. Index ~Terms - Digitization, IIOT, Predictive maintenance, Sensor technologies, Risk mitigation, Asset integrity, cost reduction, Safety.	John Hope (Exertherm)
SA22_65	**CO2 reduction by turbine replacement with Electrical High-Speed Drive Systems** Regulations on CO2 emission reductions, as well as potential taxation on CO2 production are coming in place worldwide. There are many possible ways to reduce CO2 emissions in Chemical and Petrochemical plants. One is to replace Steam Turbine (ST) or Gas Turbine (GT) equipment drives with electrical drivers. This can be done for new plants, as well as for existing plants, however, the requirements can be very different.	Jeremy Andrews (Siemens)

Réf.	Title	Presenters
SA22_66	**Electrical Voltage Dip Impact Mitigation** The paper will give an overview of the Process Industry Practice (PIP) ELGL07 for designing a power system utilizing the CIGRE-CIRED-UIE concept of Process Immunity Time (PIT). The aim of this system design approach is to keep the process plant immune to electrical voltage dips and therefore help in reducing production losses. The PIP ELGL07 voltage dip impact mitigation program addresses the application of both under-voltage ride-through and under-voltage restart capabilities for motors by screening the most critical parts of the process via the concept of Process Immunity Time (PIT). It is a multi-disciplinary approach in which Process (Chemical), Process Control (Instrumentation & Control), Mechanical (Rotating Equipment) engineers arrive at the most critical parts of the process, the immunity time prior to which mitigation has to be applied using an iterative process and by taking into consideration the techno-economic feasibility of implementing such a scheme. The paper will describe this method using example of a typical process plant power distribution system.	Mohammed Ashraf Ali (Sabic)
SA22_67	**Supporting decarbonization – an introduction to electro-mechanical ASD** Electrification of energy plants is an evolving trend as operators look to decarbonise facilities. This paper focuses on electro-mechanical ASD which can be an effective solution to turbine driver replacement or new plant versus large power electronic ASD, for speed regulation of driven equipment up to 20MW. Electro-mechanical ASD utilize the power split principle which can result in efficiency gains of up to 2.5% versus a full-scale power electronic ASD. The drive consists of a fixed speed motor, two smaller servomotors connected to a regenerative ASD providing control power and the main planetary gearbox which connects to the driven equipment. The paper evaluates the underlying theory behind the technology, benefits in comparison to full-scale ASD, starting performance, reliability and availability. Assessment of TOTEX including lifecycle energy consumption and carbon dioxide emissions savings of the hybrid electro-mechanical ASD in comparison to the alternative traditional full-scale ASD are included. Finally, a case study is presented detailing a 5MW pump drive train upgrade.	Wissam Moubarak (Voith)

Réf.	Title	Presenters
SA22_68	**Significance of Touch Voltage & Loop Impedance in Saudi Building Code & IEC** Saudi Building Code encompassing the Saudi Electrical Code SBC 401 has now been implemented for all Industrial buildings in Stage 2 of implementation. The Code has requirement for basic protection and fault protection. Prospective touch voltage shall not persist for a time sufficient to cause a risk of harmful physiological effect in a person exposed to such live equipment. This necessitates automatic disconnection of protective device within specified time limit. SBC 401 provides the loop impedance requirement to satisfy the adequate L-G fault current. This requirement which is built around IEC 60364-4-41 statutes, needs to be revisited for LV power systems. Specific LV case studies shall be demonstrated to show complexities involved and mitigation. Identical requirements in UK IET wiring regulations (BS7671) shall also be discussed.	Chirantan Gupta (Sabic)
SA22_69	**Field Development Power Demand Optimization amidst Subsurface Uncertainties** Electrical Submersible Pump (ESP) power requirements are calculated based on the data extracted from observations or test wells which represents 5% of total wells that are developed for oil production. The calculations also consider additional factors and compensation to account for subsurface uncertainties, production decline due to water cut, cyclic nature of oil production, and outages etc. As such the calculated individual ESP power represents the peak operating conditions. This paper analyzes the variables of reservoir and provides a method to calculate a load factor that can be applied to establish the average power demand for all ESPs over the life cycle of oil producing field. As a result, the average overall power demand will be reduced by more than 50% of the calculated peak power demand and accordingly will allow to optimize the required electrical network. In case of offshore electrical network, this approach will further reduce the required shunt reactive compensation and thereby mitigate its associated technical issues.	Satish Chandra Kurapati (Saudi Aramco)
SA22_70	**Implications of IEEE-1584-2018 on Standard Arc Flash Mitigation Schemes** This paper highlights the major changes that the recently published IEEE 1584-2018 makes to the calculations of the arc flash incident energy and boundary. The new standard was published in December, 2018, and considers new factors, including electrode configurations and the enclosure dimensions of the electrical equipment. These factors were not considered in the 2002 version of the same standard. The paper also highlights the impact of new changes on electrical equipment installed in the facilities of a large oil company. The new arc-flash model might increase the arc flash energy on electrical equipment beyond the safety limits specified in the company's engineering requirements. Therefore, the report recommends a way forward to minimize the impact of the new changes for existing and new facilities.	Cory Helfrich (Saudi Aramco)

Réf.	Title	Presenters
SA22_73	**Process Electrification and application of net zero power hub solution** Momentum is continuing to gather at pace regarding a relatively little-known piece of this puzzle – the electrification of existing and future oil and gas platforms and its integration with clean power sources. Greenfield assets with adoption of electrification into the design, allowing for key features such as energy storage and/or renewable sources of power can abate emissions by 2-3MtCO2 per year. With rapid changes to available technologies, the pace of adoption of digital analytics by industrial clients must change, hybrid power management hub helps to operate efficiently operation of the facility. The aim of this paper is to present the process electrification concepts for Oil&Gas applications and detail net zero journey with hybrid generation mix and its management through hybrid power management. Application of predictive control of onsite energy using microgrid advisory layer are covered in detail which can help reader to define use cases to engineer solutions.	Shailesh Chetty (Schneider Electric) Renato Alberto Finol Romero (Schneider Electric)
SA22_74	Achieving operational excellence in LV systems through the application of safe, efficient and intelligent solutions Striving to achieve excellence in our personnel lives is a daily challenge for some but achieving operational excellence in critical petrochemical installations requires the designer to understand and apply the latest technologies and designs available on the market. This paper will explore these technologies and designs in LV systems, providing a detailed understanding of the implementation of safe, efficient and intelligent solutions to aid this drive for operational excellence. The IEC standards promote innovative thinking and allow manufacturers the freedom to develop pioneering designs to enhance the predictability, safety, reliability and efficiency of their assemblies. The core technology applied in LV systems is continually evolving and this paper will provide a comprehensive understanding of advancements in these technologies and designs and summarize the proven added value that customers experience in new and existing installations.	Mohammad Shawki Hilal (Eaton Arabia)

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The following tutorials will be presented at the 8th PCIC energy Middle East 2022 – Al Khobar

Réf.	Title	Presenters
SA22_63	**Fundamentals of Partial Discharges in Medium Voltage Cables** After a very successful and outstanding well received tutorial about Partial Discharges on MV cables at the PCIC in London, Rene Hummel offered to bring knowledge in his unique and entertaining way to the PCIC Middle East. The fundamentals of Partial Discharges will be discussed – why and how do Partial Discharges happen. The examples and over 50 photos of the presentation will be based on testing of over 200.000 MV cables. The most common reasons for Partial Discharges on MV cables will be shown and how to prevent them. The tutorial will help to gain a deeper understanding about Partial Discharges, will address some of the myths around it and demystify the whole subject.	Rene Hummel (Imcorp)
SA22_71	**Arc-Flash Hazards and Mitigations in Metal-clad Switchgear** According to the National Fire Protection Association (NFPA) 70E: Standard for Electrical Safety in the Workplace, an arc flash hazard "is a dangerous condition associated with the release of energy caused by an electrical arc." Arc-flash events can cause dangerous and potentially fatal levels of heat, ultraviolet radiation, blast pressure, flying shrapnel, and deafening sound waves. Arc-flash hazard imposes danger to working personnel on the switchgear and can cause excessive damage to switchgear. As a way of arc-flash mitigation, design engineers have a few options to reduce system voltage or fault currents, including grounding practices and the application of current-limiting fuses. However, the best and most direct way to reduce arc-flash hazards is to reduce fault-clearing times, thereby reducing the overall incident energy. This tutorial session covers the following:- • Arc-Flash hazard basic • Arc-Flash risk analysis • Arc-Flash mitigation options (various non-relaying and relaying approaches) • Case-study of Arc-flash protection relaying	Rajkumar Swaminathan (SEL)

Réf.	Title	Presenters
SA22_72	**Optimized Motor and Starter Selection for Large Electric Drive Systems** Large electric motors and starting devices, rated 2MW and above, are widely used in the Oil and Gas industry for their reliability, efficiency and operational flexibility. Typical applications include centrifugal and reciprocating compressors, pumps, fans and extruders. A proper selection of the electric motor and starting device technologies is paramount to meet the desired performance, optimize capital expenditure, optimate carbon emissions and guarantee reliability with the lowest possible operating cost. This paper will propose possible solutions based on the driven load characteristics to support a cost-effective electric motor and starting system. It will evaluate potential impact on the power supply when starting a large motor and ways to avoid excessive voltage drop. For a proper starting device, Voltage Source Inverter (VSI) to be used as “Pony-Converter” will be presented. Real cases will be explored, first a 30MW motor driving a large centrifugal gas compressor with direct on-line starting and second a 12.7MW main air compressor driven by an induction motor and started with a pony-converter.	Luiz Santos (WEG) Fredemar Runcos (WEG)

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