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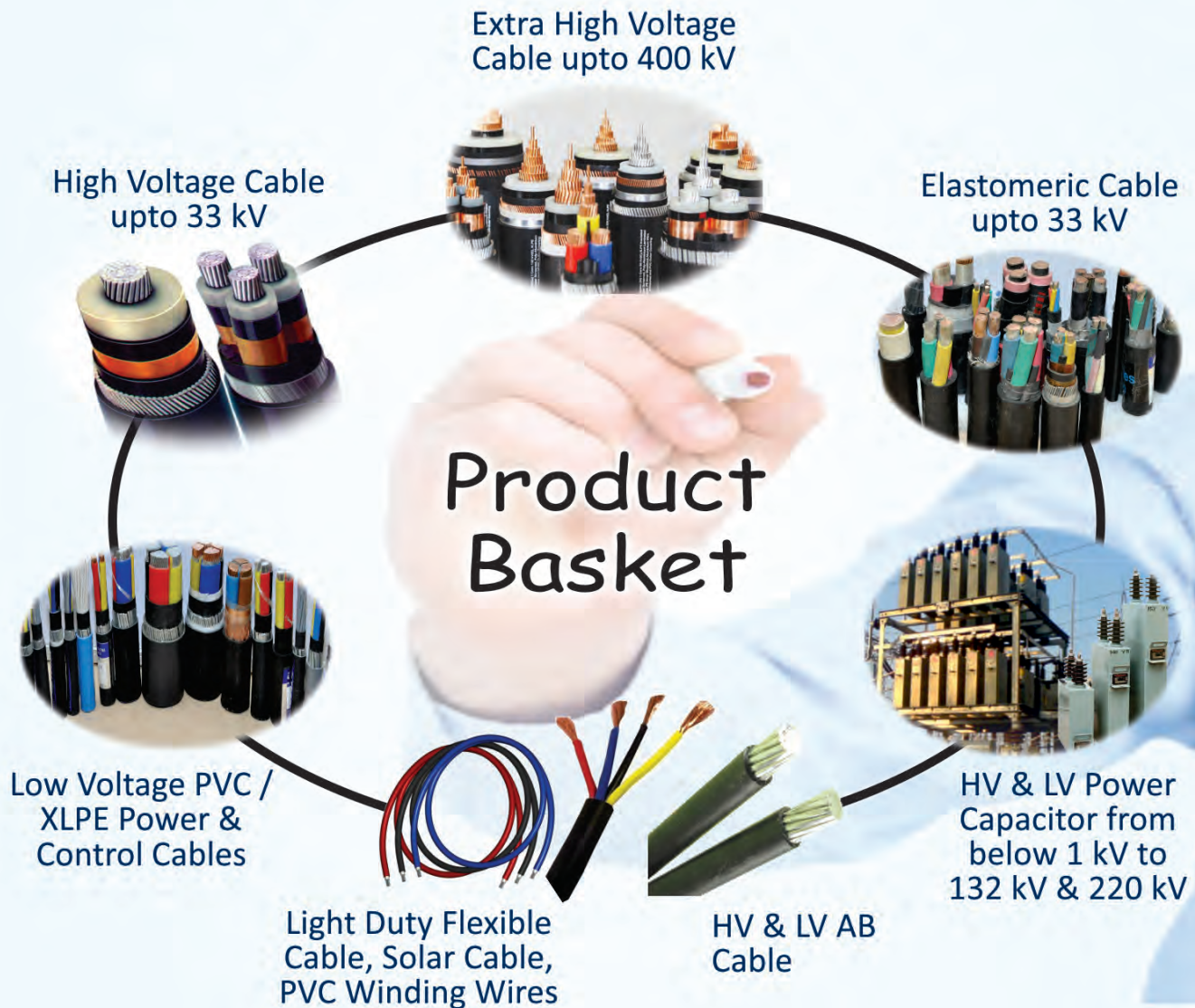
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From the Publisher's Desk

India Witnesses All Time Record High Demand of Power

It is a matter of great pleasure that after a long spell of pandemic-stricken, standstill condition, we are again gradually coming back to the normal state of life. Enough, it's enough, let us now hope the situation to improve further.

Our country has witnessed the highest ever demand for power at 12:01 hours on 7th July 2021. This demand of 200,570 MW was 17.6% higher than in July 2020 (on 2nd at 22:21 hours). This was brought out in the system operations highlights for July 2021, put out by the Power System Operation Corporation Ltd. (POSOCO). The report also states that average energy consumption per day recorded in Jul'21 (4,049MU) that was 10.6% higher than in Jul'20 (3,662MU). The 'Maximum All India Energy Met' also showed an all-time high. It was recorded at 4,508 MU on 7th July 2021, which was 14.7% higher than 3,931 MU on 28th July 2020.

Renewable Energy sector has also seen impressive gains. Average Solar Generation recorded in Jul'21 (158MU/day), which was 7.6% higher than in Jul'20 (147MU/day). Average Wind Generation recorded in Jul'21 (349MU/day) was 64.5% higher than in Jul'20 (212MU/day). Additionally, solar and wind generation recorded an all-time high of 43.1 GW on 27th July 2021. Earlier, the record was 41.1 GW on 11th Jun'21.

Reserve Regulated Ancillary Service (RRAS) – Energy dispatched under Regulation Up & Down were 113.8MU & 334.8MU respectively in Jul'21. Automatic Generation Control (AGC) – Total regulation Up & Down signal dispatched under AGC were 46.1 MU & 105.2 MU respectively in Jul'21. All India Grid Frequency – All day grid frequency remained 74.9% (average) of time within IEGC band (49.9Hz-50.05Hz) in Jul'21, which is slightly higher than the average duration in previous month (74.5%).

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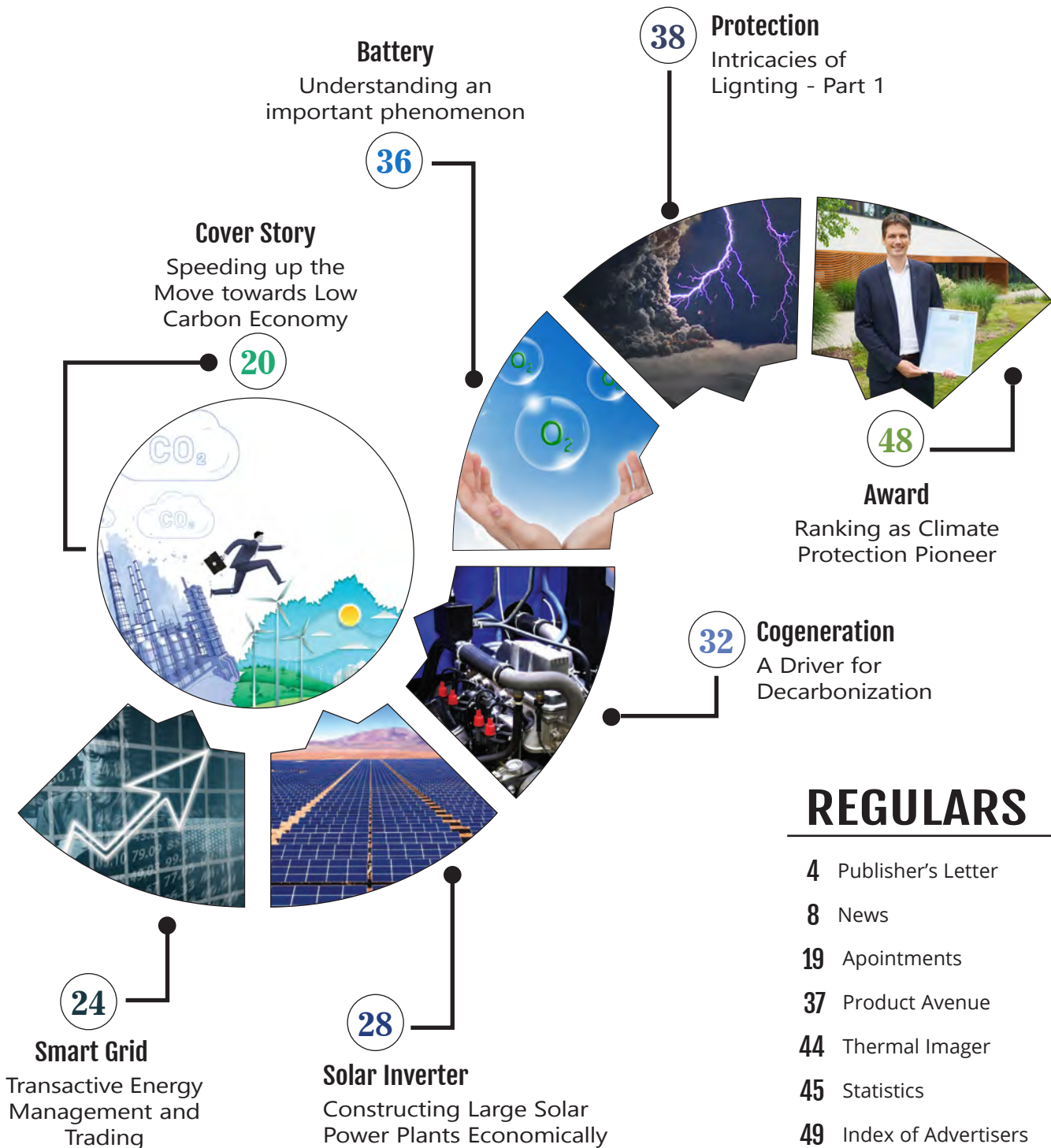


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Contents

Vol. 61 | No. 08 | August 2021



REGULARS

- 4 Publisher's Letter
- 8 News
- 19 Apointments
- 37 Product Avenue
- 44 Thermal Imager
- 45 Statistics
- 49 Index of Advertisers
- 50 Events



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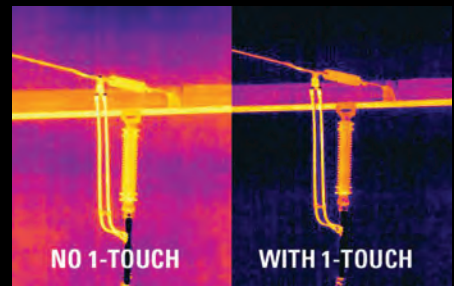
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UNION GOVERNMENT SANCTIONS 7.23 LAKH SMART METERS

As per Para 8.4.3 of Tariff Policy 2016 “the Appropriate Commission may provide incentives to encourage metering and billing based on metered tariffs, particularly for consumer categories that are presently unmetered to a large extent. The metered tariffs and the incentives should be given wide publicity. Smart meters have the advantages of remote metering and billing, implementation of peak and off-peak tariff and demand side management through demand response. These would become essential in future for load-generation balancing due to increasing penetration of intermittent type of generation like wind and solar power.

Appropriate Commission shall, therefore, mandate smart meters for: i) Consumers with monthly consumption of 500 units and more at the earliest but not later than 31.12.2017 and ii) Consumers



Representative Photo by Jon Moore on Unsplash

with monthly consumption above 200 units by 31.12.2019”. Under National Smart Grid Mission (NSGM), 7.23 lakh smart meters have been sanctioned.

The aims and objectives of installing Smart Meters are to help consumers in seamless online billing process & digital payment of bills; having access to real time tracking of electricity usage; helping consumers track their consumption patterns and adopt more energy-efficient behaviours and appliances;

offering them an option to pre-pay for electricity based on their requirements and – thus be in control of their total energy spends; enable time of day metering and thus, playing a pivotal role in the integration of renewable power; helping DISCOMs function remotely by eliminating manual collections and reduced AT&C losses.

EB

MORE NUCLEAR POWER PLANTS ARE IN QUEUE

Highest priority is accorded to safety in all aspects of nuclear power viz. siting, design, construction, commissioning and operation...

Recently, in a written reply to a question in the Lok Sabha, Union Minister of State (Independent Charge / IC) Science & Technology; Minister of State (IC) Earth Sciences; MoS PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space, Dr Jitendra Singh, informed that – there are presently 22 reactors with a total capacity of 6,780 MW in operation and one reactor, KAPP-3 (700 MW) has been connected to the grid on January 10, 2021.

In addition, there are 10 reactors (including 500 MW PFBR being implemented by BHAVINI) totalling to 8,000 MW under construction at various stages.

The government has accorded administrative approval and financial sanction for construction of 10 indigenous 700 MW Pressurized Heavy Water Reactors

(PHWRs) to be set up in fleet mode. On progressive completion of the projects under construction and accorded sanction, the nuclear capacity is expected to reach 22,480 MW by 2031. More nuclear power plants are also planned for future.

Nuclear power plants are designed adopting safety principles of redundancy, diversity and provide fail-safe design features following a defence-in-depth approach. This ensures that there are multiple barriers between the source of radioactivity and the environment.

The operations are performed adopting well laid out procedures by highly qualified, trained and licensed personnel. Appropriate Personal Protection Equipment and monitoring aids are provided to all the personnel working in the nuclear power plants.

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INDIA USES MORE THAN 70% OF INDIGENOUS EQUIPMENT FOR WIND POWER PRODUCTION

The union government has put in place a system of Approved List of Models and Manufacturers, and only equipment manufactured by manufacturers in the approved list is allowed to be used for Wind Energy Projects. Now, more than 70% of the equipment is manufactured in India.

The government has taken several steps to promote renewable energy, including wind energy, in the country. Some of those are: i) Permitting Foreign Direct Investment (FDI) up to 100% under the automatic route; ii) Waiver of Inter State Transmission System (ISTS) charges for inter-state sale of solar and wind power for projects to be commissioned by 30th June 2025; iii) Declaration of trajectory for Renewable Purchase Obligation (RPO) up to the year 2022; iv) Setting up of Ultra Mega



Representative Photo by Artur Zudin on Unsplash

Renewable Energy Parks to provide land and transmission to RE developers on a plug and play basis; v) Laying of new transmission lines and creating new sub-station capacity for evacuation of renewable power; vi) Setting up of Project Development Cell for attracting and facilitating investments; vii) Standard Bidding Guidelines for tariff based competitive bidding process for procurement of Power from Grid Connected

Solar PV and Wind Projects; viii) Government has issued orders that power shall be dispatched against Letter of Credit (LC) or advance payment to ensure timely payment by distribution licensees to RE generators; and ix) Conducting skill development programmes to create a pool of skilled manpower for implementation, operation and maintenance of RE projects. ❶

INDIA ON TRACK TO ATTAIN ITS RE DEVELOPMENT GOAL

Being one of the earliest proponents of renewable energy, India has been rigorously working to be a green-power-based economy...

Addressing the repeatedly raised questions on India's target versus actual achievement in the field of renewable energy deployment, recently in Rajya Sabha, through a written reply, the Union Minister for Power and New and Renewable Energy, R.K. Singh has informed the following. The Government of India had set a target of 1,75,000 MW installed capacity from renewable sources by the year 2022, which includes 1,00,000 MW from Solar, 60,000 MW from Wind, 10,000 MW from Biomass and 5000 MW from Small Hydro. As on 30.06.2021, the total capacity of Renewable Energy installed: under installation and under tied was 96.95 GW. This does not include large Hydro, which is also renewable.

As on 30.06.2021, the total power generation capacity installed from non-fossil fuel sources was

150.06 GW; which is 39% of the total installed capacity. Therefore, India is well in its way to achieving, and surpassing its Nationally Determined Contribution (NDC) target that was 40% capacity by non-fossil-fuel sources by 2030.

Further, to promote the renewable energy sources, the following steps have been taken: i) Waiver of inter-State transmission charges on transmission of the electricity generated from the solar and wind sources, for projects to be commissioned up to 30th June 2025; ii) Green energy corridors have been developed to evacuate power from the Renewable Energy Sources; and iii) Renewable Purchase Obligation Trajectory has been notified with the objective of creating renewable power capacity of 175 GW by year 2022. ❷



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HOUSING SOCIETY IN MUMBAI GOES FOR INSTALLING SOLAR ENERGY PLANT

Oorjan Cleantech a technology and finance enabled distributed solar company has recently installed a solar plant on the Mahavir Universe Phoenix Society at Bhandup in Mumbai. Its capacity is about 100 kWp. Earlier, the company has also installed hundreds of projects across 15 states in India.

The installation has been done across the high-rise towers comprising more than 230 solar panels installed over 7500 square feet shadow free area. The society followed a formal procedure to select the engineering and installation partner and finalized with Oorjan a company led by IITians and brings the best of solar technology, data and financing under one roof to empower the solar revolution in India.

The Indian government has an ambitious target



A view of the solar installation in the Mahavir Universe Phoenix Society...

of 100GW (~USD 100 Billion) solar capacity deployed by 2022, out of which 40% is rooftop – and to emerge as a leader in climate action, it needs to prioritize solar rooftop photovoltaic (PV) especially among residential buildings users.

Oorjan previously installed solar projects across towers in Dheeraj Dream, which is likely to be the largest housing society solar projects in Mumbai with 1600+ solar panels. While commenting on the project, Gautam Das, Co-founder & CEO, Oorjan Cleantech Private Limited, said, “This project is expected to save Rs 20 lac every year for the society and the green impact is equivalent

to planting 4,500 teak wood trees. We have 1500 customers across in India and we are committed to reach 10,000 soon.”

ET

HINDUSTAN ZINC'S CAPTIVE POWER PLANTS WIN AWARD

In 2021, total 1 MW of ground-mounted solar power plants were commissioned taking the total captive solar power capacity of the company to 40.42 MW...

Hindustan Zinc Ltd. (HZL), a Vedanta group company, has won the Gold Award at SEEM Awards for best efforts towards improving energy efficiency, thereby supporting India's journey towards climate change and sustainable development. The company's Chanderiya Lead Zinc Smelter (234 MW), Dariba Smelting Complex Captive Power Plant (160 MW), Zawar Captive Power Plant (90 MW) were felicitated with the Gold Award at the SEEM National Energy Management Award Ceremony.

Commenting on receiving the award, Arun Misra, CEO-Hindustan Zinc, said “We recognize our responsibility to contribute to the global effort of decarbonizing footprint. We at Hindustan Zinc are committed to run our operations on low carbon and carbon-neutral technologies. Over the years, we have continuously invested in technology and increased

our portfolio of renewable power to make our Captive Power Plants more green, reliable, efficient, and sustainable. This has contributed significantly to GHG saving of 12,343 tCO_{2e} and energy saving of 4 Million Units (MU) of electricity.”

Along with the motive to reduce the company's carbon footprint on a sustainable basis through investments in green energy, the company has also expanded its operations to renewable power businesses. The company's captive thermal, solar, and waste heat recycling power plants provide low-cost and reliable power to its operations.

During the year, the company produced solar power of 83.43 million units, waste heat energy of 203.13 million units and wind power of 362.93 million units leading to a reduction of 551695 MT of CO₂ through green power.

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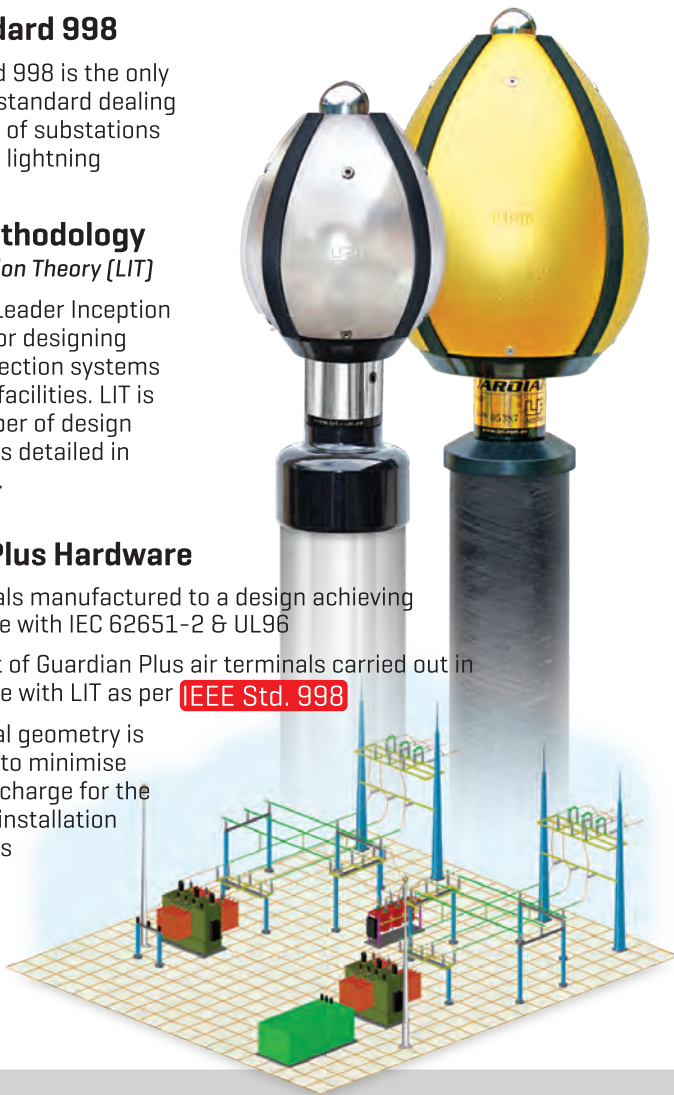
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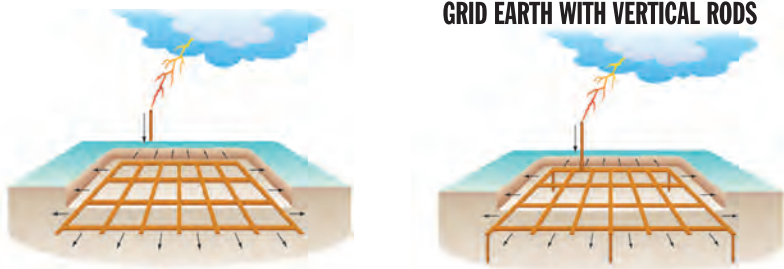


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AMPLUS SOLAR MAKES PRESIDENT KOVID'S PARENTAL HOME GREEN

HomeScape, the residential venture of Amplus Solar, has successfully solarized 'Milan Kendra', the parental home of the President of India Ram Nath Kovind. The residence where President Kovind was born, located in Paraunkh, a village over 70 km from Kanpur, is now powered by a 5 kW solar plant set up on its rooftop.

The solar plant was gifted by HomeScape to support the government's vision and initiatives to promote solar. It was installed just prior to President Kovind's Rail Yatra to his parental village for the inauguration of 'Milan Kendra'.

Commenting on the development, Sanjeev Aggarwal, Managing Director and CEO, Amplus Solar, said, "Rooftop solar, especially in the residential segment,



President of India Ram Nath Kovind (R) during inauguration of the solar plant...

is an ideal solution for a country like India where land is scarce and expensive. Installing solar at 'Milan Kendra' has been an honour for us at Amplus Solar. We are certain this will surely raise awareness and provide a much-needed impetus to the residential solar segment."

The solar plant was installed within a single day by the HomeScape team, right from site inspection to commissioning, with the assistance of the Discom (Dakshinanchal Vidyut Vitran

Nigam), UP Power Corporation and the UP PWD. The plant will generate a total of 172500 kWh of electricity through its lifetime and will help mitigate 141 tons of CO2 emissions. It was commissioned in the presence of President Kovind's elder brother Ramswaroop Bharti and was inaugurated by the President himself. **ET**

TATA POWER PARTNERS WITH HPCL TO PROLIFERATE EV CHARGING STATIONS

Development and availability of electric vehicle for charging infrastructure is a key requirement for the proliferation of EVs in India...

Tata Power has signed an agreement with Hindustan Petroleum Corporation Limited (HPCL) to provide end-to-end EV charging stations at HPCL's retail outlets (petrol pumps) in multiple cities and major highways across the country. Tata Power is a pioneer in the EV Charging space and owns an expansive network of over 500 public chargers in 100+ cities covering petrol pumps, metro stations, shopping malls, theatres and highways. The company is present across all segments of the EV eco-system – public charging, captive charging, home, workplace charging and ultra-rapid chargers for buses. The charging is enabled with the Tata Power EZ charge mobile platform (an award winning app) that makes it a seamless experience to vehicle owners.

Commenting on the partnership, Sandeep Bangia, Head - EV Charging, Tata Power, said, "This strategic tie-up provides us access to a vast retail base of HPCL, especially in cities and along the key highways. The move will tremendously benefit the EV users as it will not only provide them easy access to charging points but also remove the range anxiety, resulting in wider adoption of electric vehicles in the country."

Detailing further on the development, ED Retail, HPCL, Sai Kumar Suri, said, "HPCL with its vast network comprising more than 18000 retail outlets and Tata Power with its strong presence and expertise in the EV charging segment bring a unique strategic partnership to create a pan India charging ecosystem with end-to-end solutions." **ET**

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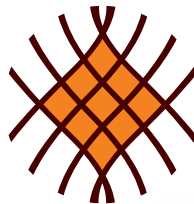
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TRIAL FOR AUTOMATED BLADE FINISHING PROGRAM FINDS SUCCESS

GE Renewable Energy, LM Wind Power and GE Research in partnership with the U.S. Department of Energy's (DOE's) National Renewable Energy Laboratory (NREL) had launched the 'Automated Blade Finishing' program in 2020, aiming to improve throughput, Environmental Health & Safety (EHS) and quality in wind turbine blade manufacturing. Blade finishing includes trimming excess material after moulding and grinding blade surface to meet quality requirements.

The program's vision is to leverage knowledge of advanced composite processing together with sensing, robotics and automation to develop low-cost solutions for wind blade finishing with potential to increase throughput by 30% and improve EHS in factories.

Despite the COVID-19 pandemic, the team moved rapidly from concept to prototype boosted by the capabilities offered at NREL's Composites Manufacturing Education



A view of the blade finishing work...
Picture Credit: LM Wind Power

pivot as necessary and leverage digital tools to perform virtual validations and reviews with partners.

Commenting on the development, Arvind Rangarajan, Technical Leader Automation for GE Renewable Energy, industry lead for the program, said, "GE Renewable Energy is excited about the outcome of pilot project and look forward to industrializing this technology." Funding for the program came from DOE's Advanced Manufacturing Office (AMO) and Colorado's Office of Economic Development and International Trade (OEDIT).

BT

SCOTTISH POWER, SHELL TOGETHER BID TO BUILD LARGE-SCALE FLOATING WINDFARMS

The combined Scottish Power Renewables/Iberdrola and Shell portfolio includes over 2GW of operational offshore wind, over 11GW of offshore wind in development...

Scottish Power and Shell have teamed up to bid to develop the world's first large-scale floating offshore windfarms in the north-east of Scotland. The proposed projects, a part of Crown Estate Scotland's ScotWind Leasing, will help decarbonise the UK and support the green economic recovery. The partnership has submitted multiple proposals for new large-scale floating offshore windfarms as part of Crown Estate Scotland's ScotWind Leasing.

With decades of experience working offshore, a significant presence in Scotland and strong innovation capabilities derived from delivering large scale energy infrastructure projects, Scottish Power and Shell together provide the right blend of skills and experience to successfully deliver these exciting projects.

Floating offshore wind, a technology that is poised to scale up, is suitable for use in deeper water zones where fixed foundations aren't feasible making it ideal for Scottish waters. It will become an increasingly important part of the energy mix in the UK as more and more offshore wind power is brought on to the grid to meet Net Zero targets.

Throwing light on the development, Scottish Power CEO, Keith Anderson, said, "Scotland is the windiest country in Europe and has the biggest and most experienced offshore sector. Bringing Scottish Power and Shell's collective knowledge, experience and expertise together means we're perfectly placed to lead the way in developing large-scale offshore floating windfarms and creating a new green industry with massive potential for exporting our skills and experience globally."

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SIEMENS ENERGY TO PROVIDE EAD SOLUTION TO BIOREFINERY

The Finnish company UPM-Kymmene has selected Siemens Energy to supply electrification, automation and digitalization (EAD) packages for a next-generation biorefinery currently under construction in Leuna, Germany.

The biorefinery will be the first industrial-scale facility of its type ever built. It will apply novel process innovations to sustainably convert 100% wood into bio-based Mono-Ethylene Glycol (MEG), Mono-Propylene Glycol (MPG) as well as Renewable Functional Fillers (RFF). Both MEG, MPG as well as functional fillers have traditionally been produced using fossil-based raw materials. UPM will provide alternatives to considerably reduce the CO₂ footprint of end-products such as PET bottles, packaging materials, textiles, or rubber products used in various automotive applications. Siemens Energy's scope of supply for the project includes: 1)



*An example of a biorefinery similar to the one UPM-Kymmene is building...
Photo courtesy of UPM-Kymmene*

Electrification: mill-wide medium- and low-voltage power distribution system and drive system (motor control centre, variable speed drives, motors), 2) Automation: Distributed Control System (DCS) for multiple process areas and remote I/O cubicles (total of 9,000 process objects), including safety and ATEX functions for explosive atmospheres and 3) Digitalization: complete digital twin for the entire plant, covering the mill's whole life cycle – from integrated engineering

to integrated operation.

The biorefinery is scheduled for start-up in late 2022. When fully operational, it will have a total annual capacity of 220,000 tons. Commenting on the project, Jennifer Hooper, Senior Vice President, Industrial Applications Solutions for Siemens Energy, said, "We look forward to helping UPM reduce the world's reliance on chemicals produced from fossil fuels as we move toward creating a more sustainable world."

31

EHC'S MEMBERS' LIST DOUBLES, REACHES 14

Each member company will determine its own specific pricing models and select their own charging equipment providers...

The Electric Highway Coalition (EHC) has doubled the number of companies committed to enabling long distance Electric Vehicle (EV) travel through a network of DC fast charging stations connecting major highway systems.

Membership in the EHC – which is committed to helping enable long distance all-electric travel by adding fast charging stations along U.S. highway routes – has now grown to include AVANGRID, Consolidated Edison, DTE Energy, Eversource Energy, Exelon, FirstEnergy Corp., ITC Holdings Corp., and National Grid. Formed in March 2021, EHC began its membership with American Electric Power, Dominion Energy, Duke Energy, Entergy Corporation, Southern Co., and the Tennessee Valley Authority.

Together, the 14 members – representing 29 states

and the District of Columbia and serving more than 60 million customers – are committed to growing corridor EV charging solutions within their service territories and working with other members to ensure the charging resources enabled EV drivers convenient charging options and seamless travel routes.

In addition to expanding membership, the EHC has further defined its goals and objectives while beginning cooperation in pursuit of their shared objective. The members have agreed to work together to ensure efficient and effective fast charging deployment plans that enable long distance EV travel, avoid duplication among coalition utilities, and complement existing corridor fast charging sites. Ideally, EHC members are pursuing sites that are easily accessible for drivers located less than 100 miles apart.

31

V. SPETH ASSUMES THE ROLE OF MANAGING DIRECTOR AT BLACKROCK'S APAC TEAM



She was in the 'Top 40 under 40' list of the Capital business magazine in Germany...

BlackRock Real Assets has appointed Valerie Speth as a Managing Director for the firm's APAC Renewable Power team, effective from July 2021. Speth will lead investment and portfolio management efforts in Southeast Asian economies for BlackRock's current flagship Global Renewable Power strategy and the Climate Finance Partnership (CFP) program in Asia.

As a qualified mechanical engineer, Speth has more than 15 years' experience in renewable energy businesses in Europe

and APAC, in the areas of strategy, M&A and operations.

Prior to joining BlackRock, she was Regional Director Asia Pacific for juwi, a global expert in turnkey renewable power projects. Speth grew the portfolio to more than 1 gigawatts of wind and solar projects in seven APAC markets. Before relocating to APAC, she led corporate strategy and M&A at juwi in Germany, and worked at E.ON and Accenture, specializing in the energy sector. 

A. MACKENZIE JOINS ROYAL DUTCH SHELL AS NON-EXECUTIVE CHAIRMAN



He was knighted in 2020 for services to business, science, technology and UK-Australia relations...

Sir Andrew Mackenzie has been appointed Chair of the Board of Royal Dutch Shell plc with effect from May 19, 2021. He joined BHP, the world's largest mining company, in 2008, becoming Group CEO from 2013 to 2019, when he systematically simplified and strengthened the business, and created options for the future. He also made BHP the first miner to pledge to tackle emissions caused when customers use its products.

From 2004 to 2007 at Rio Tinto, he was

Head of Industrial Minerals, then Head of Industrial Minerals and Diamonds. Prior to this, Sir Andrew spent 22 years with BP, joining in 1982 in research and development, followed by international operations and technology roles across most business streams and functions – principally in exploration and production and petrochemicals, including as Chief Reservoir Engineer and Chief Technology Officer. Latterly he was Group Vice President for Chemicals in the Americas, then Olefins and Polymers globally. 

Y. LONG TAKES OVER AS INDEPENDENT DIRECTOR OF NIO INC.



She is a member of the World Economic Forum's Young Global Leaders Advisory Council...

NIO Inc., a pioneer and a leading manufacturer of premium smart electric vehicles in China, has appointed Yu Long as the Independent Director in the company's Board with effect from July 12, 2021. Long will also serve as a Member and the Chairperson of the nominating and corporate governance committee of the Board.

Long currently serves as the Founding and Managing Partner of BAI Capital. She also serves as a Member

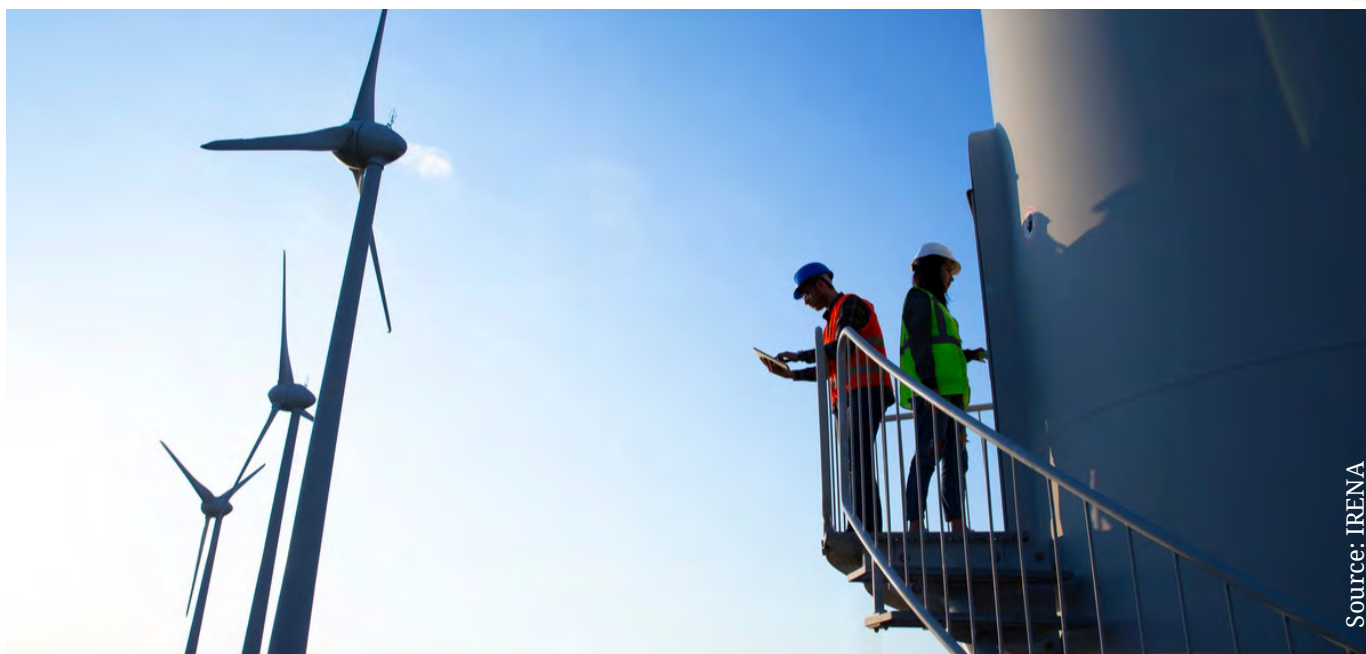
of Bertelsmann Group Management Committee and the Governor of China Venture Capital and Private Equity Association Limited. Formerly, she was the Chief Executive Officer of Bertelsmann China Corporate Center and the Managing Partner of Bertelsmann Asia Investments. Prior to that, she was a Principal at Bertelsmann Digital Media Investments. She joined the International Media, Services and Education company via the Bertelsmann Entrepreneurs Program in 2005. 



SPEEDING UP THE MOVE TOWARDS LOW CARBON ECONOMY

Considering the importance and urgency of prevention of climate deterioration, it is necessary that every country's government makes appropriate policies and implement those to enforce transition towards green power generation. IRENA is all set to raise the matter in COP 26 and push to initiate UN high-level dialogue on this issue...
- P. K. Chatterjee (PK)

During the last few years, globally the paradigm of the Oil & Gas (O&G) companies has started changing towards fostering low carbon power generation projects. Obviously, this laudable step by the multi-billion, multi-national O&G companies can entirely reshape the world. However, the question is 'how soon' – because we have reached the critical stage where we cannot wait any longer. Even one decade back, the technologies



were in the developing stage, however, today the scenario is completely different. Low carbon (renewable power generation) technologies have matured enough to compete the fossil-based technologies.

Global Energy Transformation: IRENA

When in 2018, the International Renewable Energy Agency published its report (Roadmap to 2050) on Global Energy Transformation, in its foreword, the then Director-General, IRENA, Adnan Z. Amin said, “In an era of accelerating change, the imperative to limit climate change and achieve sustainable growth is strengthening the momentum of the global energy transformation. The rapid decline in renewable energy costs, improving energy efficiency, widespread electrification, increasingly ‘smart’ technologies, continual technological breakthroughs and well-informed policy making all drive this shift, bringing a sustainable energy future within reach. While the transformation is gaining momentum, it must happen faster. Around two-thirds of global greenhouse gas emissions stem from energy production and use, which are at the core of efforts to combat climate change. To meet climate goals, progress in the power sector needs to accelerate further, while the decarbonisation of transport and heating must pick up steam.”

In his foreword, Amin pointed out that the current and planned policies offer a comparatively slow path, whereby the world would exhaust its energy-related ‘carbon budget’ in under 20 years, in terms of efforts to

keep the global temperature rise well below 2°C. The budget for a 1.5°C limit, meanwhile, would potentially run out in less than a decade.

With that backdrop, he said, “The energy system, consequently, requires rapid, immediate and sustained change. The deployment of renewables must increase at least six-fold compared to the levels set out in current plans. The share of electricity in total energy use must double, with substantial electrification of transport and heat. Renewables would then make up two-thirds of energy consumption and 85% of power generation. Together with energy efficiency, this could deliver over 90% of the climate mitigation needed to maintain a 2°C limit.”



**Adnan Z. Amin, Ex-Director-General,
IRENA**

The Emerging Challenges

The age-old idiom goes: it is easier said than done, which is quite applicable here. The O&G industry is highly capital intensive and passing through a growing phase. According to a recent research report from Research & Markets, the global O&G market is expected to grow from \$4677.45 billion in 2020 to \$5870.13 billion in 2021 at a Compound Annual Growth Rate (CAGR) of 25.5%.

A low carbon future means a journey towards an era that will involve generation of electricity from renewable sources or fuels having comparatively much low potential of emission, and gradually, the fossil fuels will be completely eliminated. It is possible only through the massive funding from all business sectors and especially, through the new outlook of the O&G companies.

However, some of the new challenges too need to be addressed through the new approach. A recent Brookings Research states, "The American public overwhelmingly favours renewable power and the costs of wind and solar power have declined rapidly in recent years. However, inherent attributes of wind and solar generation make conflicts over land use and project siting more likely. Power plants and transmission lines will be located in areas not accustomed to industrial development, potentially creating opposition.

Wind and solar generation require at least 10 times as much land per unit of power produced than coal- or natural gas-fired power plants, including land disturbed to produce and transport the fossil fuels. Additionally, wind and solar generation are located where the resource availability is best instead of where is most convenient for people and infrastructure, since their 'fuel' can't be transported like fossil fuels. Siting of wind facilities is especially challenging. Modern wind turbines are huge; most new turbines being installed in the United States today are the height of a 35-story building. Wind resources are best in open plains and on ridgetops, locations where the turbines can be seen for long distances.

Technological and policy solutions can lessen the land use impact of renewable power and the resulting public opposition. Offshore wind eliminates land use, but it raises opposition among those concerned with the impact on the environment and scenic views. Building on previously disturbed land and combining

renewable power with other land uses, like agriculture or building solar on rooftops, can minimize land use conflicts. Community involvement in project planning and regulations for land use and zoning can help alleviate concerns. Nevertheless, there is no perfect way to produce electricity on an industrial scale. Policymakers must recognize these challenges and face them head-on as the nation transitions to a lower-carbon energy system."

IRENA Re-writes its Energy Narrative

In June 2021, IRENA has published its current outlook. The new analysis states, "Accelerating energy transitions on a path to climate safety can grow the world's economy by 2.4% over the expected growth of current plans within the next decade." The Agency's 1.5°C pathway foresees the creation of up to 122 million energy-related jobs in 2050, more than double of today's 58 million. Renewable energy alone will account for more than a third of all energy jobs employing 43 million people globally, supporting the post-COVID recovery and long-term economic growth.

IRENA's 'World Energy Transitions Outlook' finds that the renewables-based energy systems instigating profound changes that will reverberate across economies and societies. Sharp adjustments in capital flows and a reorientation of investments are necessary to align energy with a positive economic and environmental trajectory. Forward-looking policies can accelerate transition, mitigate uncertainties, and ensure maximum benefits of energy transition. The annual investment of USD 4.4 trillion needed on average is high. But it is feasible and equals to around 5% of global GDP in 2019.

IRENA's Outlook also sees that energy transition is a big business opportunity for multiple stakeholders including the private sector, shifting funding from equity to private debt capital. The latter will grow from 44% in 2019 to 57% in 2050, an increase of almost 20% over planned policies. Energy transition technologies will find it easier to obtain affordable long-term debt financing in the coming years, while fossil fuel assets will increasingly be avoided by private financiers and therefore forced to rely on equity financing from retained earnings and new equity issues.

But public financing will remain crucial for a swift, just and inclusive energy transition and to catalyse private finance. In 2019, the public sector provided

some USD 450 billion through public equity and lending by development finance institutions. In IRENA's 1.5°C Scenario, these investments will almost double to some USD 780 billion. Public debt financing will be an important facilitator for other lenders, especially in developing markets.

As markets alone are not likely to move rapidly enough, policy makers must incentivise but also take action to eliminate market distortions that favour fossil fuels and facilitate the necessary changes in funding structures. This will involve phasing out fossil fuel subsidies and changing fiscal systems to reflect the negative environmental, health and social costs of fossil fuels. Monetary and fiscal policies, including carbon pricing policies, will enhance competitiveness and level the playing field.

Enhanced international cooperation and comprehensive set of policies will be critical to drive the wider structural shift towards resilient economies and societies. If not well managed, the energy transition risks inequitable outcomes, dual-track development and an overall slowdown in the progress. Just and integrated policies will remain imperative to realise the full potential of the energy transition.

Today's policies, finance and socio-economic analysis completes the outlined technological avenues for a 1.5°C-compatible energy pathway, providing policymakers with a playbook to achieve optimal results from the transition. Launched by energy leaders at the Agency's Global High-Level Forum on Energy Transition, this outlook aims to raise ambition towards UN High-Level Dialogue on Energy and Climate Conference COP26 later this year."

Things to be noted

As far as any technology transformation is concerned, the developing and the under-developed world mostly follow the trends in the USA. The same is true in the case of the power industry. The above mentioned items of information are mostly based on the latest trends being observed in the US. Thus, it is evident that with the growing awareness on prevention of climate change and rising advocacy in favour of renewable energies, the public pressure is mounting very fast – and their preference is amassing the support for renewable energies.

IRENA's present Director-General, Francesco La Camera, has pointed out, "This outlook (as reflected



in IRENA's 2021 view) represents a concrete, practical toolbox to total reorientation of the global energy system and writes a new and positive energy narrative as the sector undergoes a dynamic transition. There is consensus that an energy transition grounded in renewables and efficient technologies is the only way to give us a fighting chance of limiting global warming by 2050 to 1.5°C. As the only realistic option for a climate-safe world, IRENA's vision has become mainstream."

He has also added, "Energy transformation will drive economic transformation. Energy transition is a daunting task but can bring unprecedented new possibilities to revitalise economies and lift people out of poverty. IRENA's outlook brings unique value as it also outlines the policy frameworks and financing structures necessary to advance a transition that is just and inclusive. Each country will define what is the best for them, but collectively, we must ensure that all countries and regions can realise the benefits of the global energy transition for a resilient and more equitable world. We have the know-how, we have the tools, we need to act, and do so now."

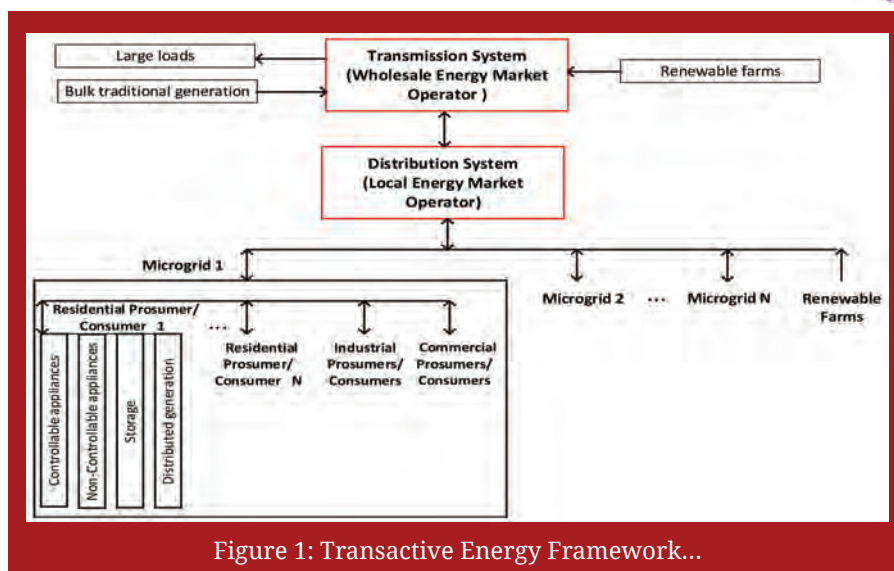
So, to prevent further deterioration of the global climate due to fossil power generation, in the work-to-do list, the top place goes to policy making & implementation at each country's governmental level. If the processes of policy making, implementation & follow-up are proper, the world's scenario is bound to change. The initiation of the process is quite evident from the decisions of some giant O&G companies like BP, Shell, Chevron, Total etc., who are all investing to support renewable energy projects. However, appropriate government policies will speed up the process of transformation.



TRANSACTIONAL ENERGY MANAGEMENT AND TRADING

Restructuring in the electricity sector, with an increase in renewable energy resources and distributed energy management technologies, offers the potential for significant improvement in the efficiency of power systems through the transactional energy framework. Energy exchange between the producer and the consumer takes place through the double auction market. Consumers and prosumers of all sizes can participate in the market using automated control. Transactional control provides the means for optimal energy management by taking advantage of intelligent devices and technologies such as blockchain and the Internet of Things (IoT)...

The most important constraint of the power system i.e., supply-demand balance constraint can be met either by optimizing the generation side or the demand side. Demand response programs focus only on the consumption side of the network. But concentrating only on the consumption side might not fully exploit the capabilities of future smart grids. Thus, there is a need for a framework that focuses not only on the



reserve requirements and reducing the losses in the power network [3]. In the P2P mechanism, the energy transactions take place without the need for a central controller.

Transactive Energy

Transactive Energy is defined as a set of economic and control mechanisms that allow the dynamic balance of supply and demand across the entire electrical infrastructure using value as a key operational parameter [4]. Decisions are made based on the price. Transactive control is the implementation of transactive energy. There is a bidirectional power flow due to the penetration of DERs such as Distributed Generation (DG), electric storage, and Electric Vehicles (EVs) in the distribution system.

The transactive energy framework helps the power system to evolve as a hybrid system of the Wholesale Energy Market (WEM) and Local Energy Markets (LEM). The wholesale energy market operator manages the network and power balance at the transmission level and the local energy market operator is responsible for managing the DERs and power balance at the distribution level. More

accurate energy forecasting needs to be done in all the levels of power systems and by all the participants of the transactive market for successful implementation of the transactive energy framework.

Transactive Energy Management Framework

In a transactive energy management system, transactive agents negotiate their actions with each other through double auction transactive markets. A transactive agent may be a residential house, industrial or commercial building, microgrid, demand response aggregator, microgrid aggregator renewable farm, etc., As seen in figure 1, the transactive control concept can be applied in all levels of the power system from residential to transmission level and it facilitates the integration of local energy market and wholesale energy market.

At the bottom level of the transactive energy framework, we have residential houses, no matter their sizes, they can participate in the retail or local energy market and modify the schedule of its controllable appliances based on the

consumption side but also on the rate of generation in both grid and demand sides [1].

Traditionally the flow of energy is from wholesale power plants to transmission systems and then to the end-use consumers of the distribution system. The flow was uni-directional, but now with the increase in the percentage of variable and intermittent Distributed Energy Resources (DERs), the way the power system operates has changed [2]. Smart meters are the key component in today's modern power grid as tracking of bidirectional power flows and data are now possible with them. Control of a large number of DERs can be done in a centralized or decentralized way. Decentralized way of trading like Peer-to-Peer (P2P) energy trading helps in lowering

cleared market price and user's local information. The transactive energy concept can also be applied inside a single building where each zone can bid or compete among themselves. Retail markets can be operated for only one Microgrid (MG) as well as for the group of microgrids.

The retail market operator is responsible for balancing the electricity supply and demand at the distribution level. Transactive control helps in congestion and voltage management in the distribution system by considering the network operational constraints. At the transmission level, the WEM operator clears the market and determines the clearing price. Participants of the WEM are large loads, traditional bulk generation, grid-level renewable farms, and Distribution Companies (DISCOs). We have forward and spot transactions in transactive markets. Forward markets operate by relying on future delivery and spot market is used for instant delivery.

Energy Trading in Microgrid Transactive Energy Framework

Microgrid transactive energy framework can have centralized or decentralized energy trading. In a centralized energy trading, all microgrid participants send their energy bids and offers to the LEM operator. LEM operator aggregates all the bids and offers to determine the market-clearing price while satisfying the network constraints. The cleared market price is sent back to the participants to initiate the transactions.

Centralized energy trading uses cloud infrastructure for data and information exchange. The main disadvantage of centralized energy

trading is scalability and risks of cyber-attacks. Decentralized energy trading uses distributed ledger technologies for the secure energy transaction process. A blockchain-based system can be used to implement decentralized P2P energy trading without involving any third party. Decentralized energy trading is more flexible and reliable.

Peer-to-Peer Trading

Recently electric distribution networks are experiencing tremendous changes with the proliferation of distributed energy resources, scilicet penetration of PV panels, battery energy sources, microturbines, etc. This trend leads to the drastic transition of market participants from consumers to prosumers. Like this peer-to-peer trading, a concept has emerged. (P2P) trading is a next-generation energy management technique for the smart grid that can enable prosumers to actively participate in the energy market either by selling their excess

energy or buying deficient energy from the grid.

So, this P2P trading poses various challenges to the grid operator in technical and economic aspects since the existing infrastructure and market mechanism is no longer supported. Financial factors such as pricing mechanism, energy management, market operations. Technical elements like network and communication infrastructure. Literature has divided the P2P Market structure into two layers, named physical and virtual layers. The physical layer comprises grid connection, metering, and communication infrastructure. Pictorial representation of the P2P trading mechanism is shown in figure 2 [5].

The Virtual Layer

It consists of an information system, market operations, pricing mechanism, and energy management system.

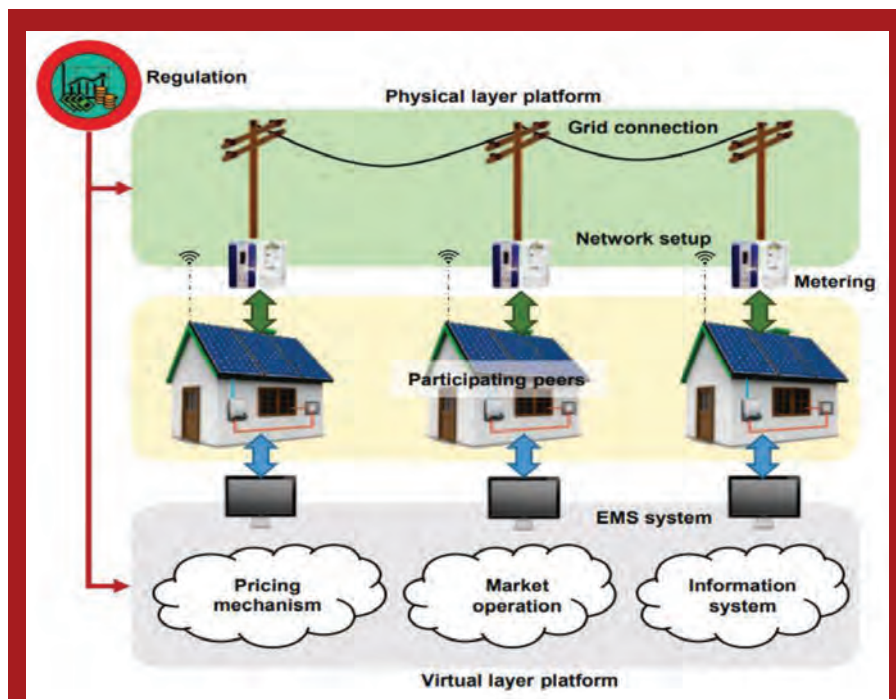


Figure 2: An illustration of different layers in P2P energy trading...

Information System

Being present in the virtual layer, it must provide some predefined set of rules to ensure the secure operation of the power system, which allows the market participants to communicate with another to share information in the energy trading process, provides equal access to all market participants, and integrate all market participants on some market platform in P2P trading. Smart contracts, a piece of code, are a promising solution deployed on the blockchain and provide the most secure trading platform. In addition, distributed ledger technology in the blockchain assures immutable financial transactions.

- **Market Operation:** Must provide some market-clearing procedure, specific bidding

format. The pricing mechanism is one of the market operations that ensure the supply and demand balance. Therefore, it should also provide different time market horizons, such as one hour in the day ahead and 15 min in real-time markets.

- **Pricing Mechanism:** It is expected that the pricing mechanism ensures supply and demand balance by providing demand response and ancillary services. Consumers can reap more profits since they may get power for a price less than Feed-in Tariff (FIT) since the marginal cost of renewable energy is very low.
- **Energy Management System:** EMS participants can access energy in a real-time manner. So, a rational prosumer who has

equipped with EMS buys power when the price is less than the marginal price.

- **Physical Layer:** Physical layer consists of information related to grid connection, metering, communication infrastructure.
- **Grid Connection:** P2P trading mechanism can be done in intra-microgrid and interconnected microgrids, sell the excess energy to the grid, and buy deficient energy from the grid. So, a microgrid should consist of effective interconnection points. Therefore, the cost of purchasing energy is more petite at these interconnections and selling energy is more, and losses in a microgrid are less.
- **Metering:** In this trading mechanism, prosumers should

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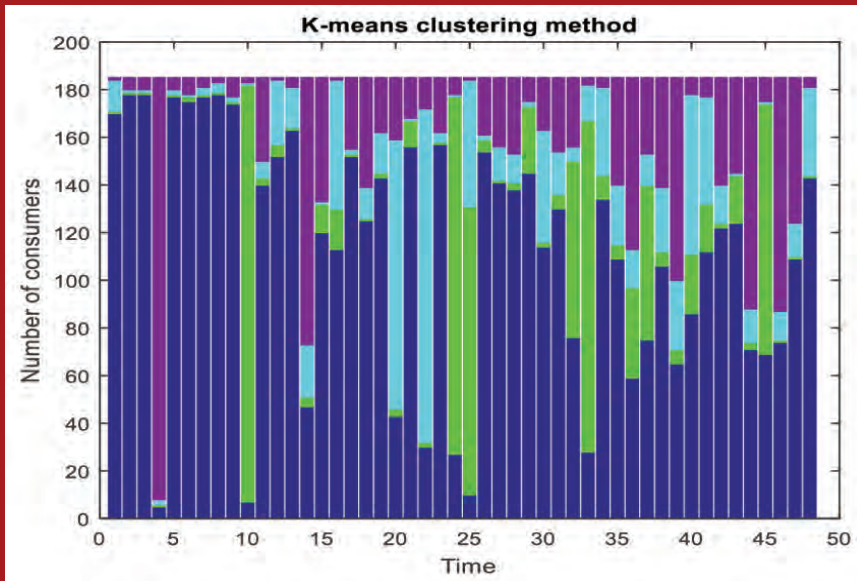


Figure 3: Hourly clustering using K-means method...

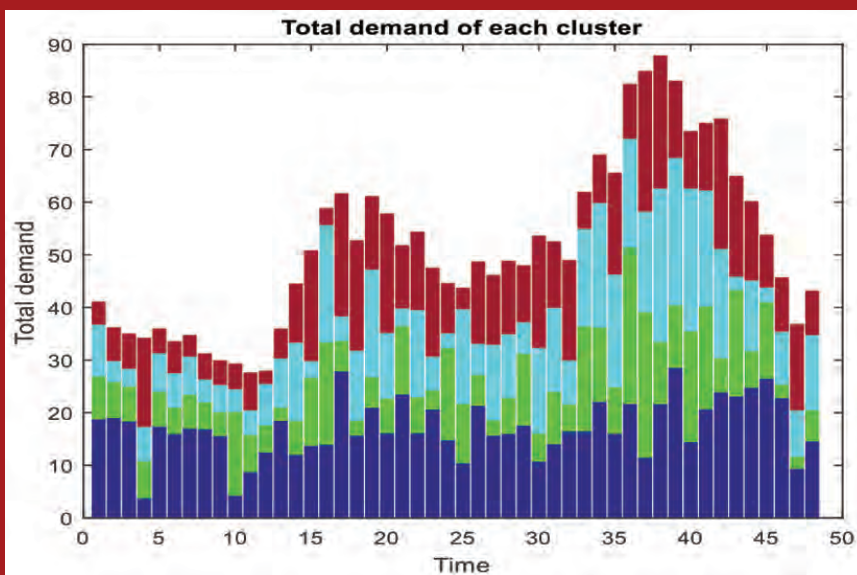


Figure 4: Total demand of each cluster...

real-time information related to energy consumption and its cost to both sellers and buyers. Based on the real-time energy consumption cost, consumers can forecast their energy consumption such that energy purchasing cost is minimized. Statistical techniques or artificial intelligence techniques can be used to forecast the load. Smart meters measure the consumption in minutes' granularity and provided better solutions to the consumers so that they can choose customized plans for electricity consumption and curtailment. Also, smart meters can share information with devices at home and with other smart meters using various communication protocols.

So, optimization of energy in smart homes can be achieved using smart meters in transactive energy management. Clustering is the basic tool used to segregate the electricity customers belonging to the same consumption levels. Segmentation helps not only in competitive energy trading but also in inter and intra-regional energy exchange. Various clustering techniques like hierarchical clustering, K-means, and fuzzy K-means are generally used to segregate customers with similar consumption behaviour. Figure 3 and Figure 4 show the hourly clustering and total demand of each cluster done by using the k-means clustering method on data collected from a group of consumers [6].

Energy Management and Trading in Indian Context

Indian Energy Exchange Limited (IEX) and Power Exchange India Limited (PXIL) are the two power exchanges facilitating short-term trade of power in India. Power trading in India takes place through long-term power purchase agreements,

be equipped with traditional and transactive energy meters such that each prosumer can participate in the P2P trading process. So, the transactive energy meter makes the participants capable of reading the energy depends on the market conditions such as generation, demand, price, network conditions.

• Communication

Infrastructure: A proper communication infrastructure must be provided by the P2P trading mechanism to consider communication latencies, throughput, reliability and security.

Energy Forecasting Using Smart Metering

Smart metering plays an important role in the transactive energy management process. Smart meters provide near

short-term bilateral contracts, and exchange. In a short-term energy exchange, there are day-ahead markets and real-time markets. The market-clearing price and the quantity of electricity are determined through the closed double-sided auction mechanism.

Power from renewable sources can be traded through Renewable Energy Certificate (REC) market and one REC is equal to 1 MWh. Congestion between the bid areas is handled through the market splitting technique and area clearing price will be determined specific to the area.

Conclusion

Transactive energy can be considered as a framework that deals with the economic issues in energy trading and technical issues in the network operations. Transaction decisions are made based on the price or the value that is capable of being

monetized. Transactive control can be implemented using a one-time information exchange approach and also an iterative information exchange approach.

In centralized energy trading, the central controller takes care of all the operations but the main challenge in implementing decentralized trading is to find the trusty participants and the way of exchanging money between them.

Energy Forecasting using smart meters described above will help in energy trading using virtual power plants as peer-to-peer transactions. The transactive grid will be a reality in the near future, which will help prosumers/aggregators to participate in the energy market. Thus, with the transactive energy framework, today's power grid can be transformed into a more reliable and sustainable smart power grid. 

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CONSTRUCTING LARGE SOLAR POWER PLANTS ECONOMICALLY

Inverters are used to convert direct current electricity generated by solar panels to grid-compatible alternating current. Silicon Carbide (SiC) can withstand higher temperatures and voltages than silicon, thus it is a more reliable and preferred inverter component. Now, KACO new energy has come out with some new solar PV inverters that can reduce costs of plant construction and operation...

In this era, it has been unanimously understood that solar energy is the future. In the last two decades, the installation cost of solar energy has decreased to the extent of 90%. However, to make it much more ubiquitous, it is necessary to lower the installation cost further. Under such circumstances, recently, KACO new energy, a subsidiary of Siemens AG, one of

the world's largest manufacturers of inverters for grid-feed solar power, has expanded its product range of high-power solar PV inverters with silicon carbide technology.

The company has started selling the new solar PV inverters with outputs of 155 and 165 kilowatts. In terms of technology, the company again relies on silicon carbide power transistors. The advantages of this thermally optimised semiconductor material result in cost savings for the construction and operation of utility-scale solar power plants.

With two new inverters, KACO new energy is targeting the builders and operators of utility-scale solar parks. The blueplanet 155 TL3 and 165 TL3 are further developments, which offer 15% more power than their otherwise identical predecessor models, thus, customers benefit from fewer inverters for the same total output of a solar power plant. Also, fewer inverters in their compact design and a weight of less than 80 kilograms simplify transport and installation.



The new silicon carbide inverters from KACO new energy for cost savings in utility-scale solar power plants...

Exceptional power density

The new 'High Power' variants are real powerhouses. This is due to the high thermal stability of the silicon carbide power transistors. This gives the inverters an exceptional power density of two kilowatts per kilogram and efficiencies of up to 99.1%. These products are optimised for installation in the cooler and more moderate climate zones. However, if someone likes to use the silicon carbide inverters in hotter regions, the original 'High Temperature' devices must be chosen. These still deliver their full performance at ambient temperatures of up to 50 degrees Celsius.

For use in every demanding installation location, the inverter housing withstands dust, water jets and salt corrosion near the sea. While the inverters thus brave adverse conditions on site, commissioning and updates can be carried out remotely via secure Ethernet communication. The surge protection for the DC side comes ex works; for the AC side and for the communication interfaces it can be easily retrofitted thanks to the fuse holders already in place.

Complementing inverter strengths

For flexibility in system design, the PV pioneer from Neckarsulm recommends the use of DC combiners. KACO new energy has just renewed its range of such string collectors in cooperation with the cabling and wiring specialists at HIS Renewables GmbH. In ground-mounted solar power plants, the inverters are installed at a central location, while the DC combiners are spread across the PV module array. This leads to short cable runs between the inverters and the transformer – and that means that there is no loss of power on the AC side.

The high efficiency of the inverters can be deployed to its fullest. Those who follow the trend towards bifacial solar modules will find DC combiners particularly useful: They leave free choice to counter the higher currents with the appropriate fuses of 25 amperes and more. 

A DRIVER FOR DECARBONIZATION



Combined Heat and Power (CHP) technology is a prerequisite for Europe to become carbon-neutral by 2050. Here is an overview of the current status and potential of the CHP technology...

Cogeneration refers to the combined generation of heat and power. With CHP, generation occurs close to the site of consumption, easing the burden on the power grids. Its high flexibility also ensures stable power generation, even when there is no wind or the sun is not shining. In contrast to conventional centralized and fossil-fuelled steam power stations, production from CHP plants can be easily capped or the plants can be shut down entirely, if necessary. So, CHP technology fits perfectly in the existing infrastructure of electricity, heat and gas grids in Europe.

Thanks to their flexibility and their optimal use of renewable energy, for instance: in the form of biomethane, hydrogen or other synthetic fuels, CHP plants are well-suited to cover residual loads in the power grid. All of these factors make CHP plants an important element of the energy supply of the future and an ideal member of the renewable energy technology family.

Advantages of cogeneration

COGEN Europe promotes the expansion of CHP across Europe. The association advocates for sector coupling and considers CHP to be the

backbone of the future European energy system – carbon neutral, decentralized and resilient.

Detailing on the merits of cogeneration, Hans Korteweg, CEO, COGEN Europe, said, “CHP has the potential to bring together the electricity, heat and gas grids. It efficiently integrates renewable energy and its use for decarbonized energy supply. CHP thus brings more reliability and flexibility to the energy system by being able to generate heat and electricity at all times. The combined generation of electricity and heat is more cost-effective, more efficient and also leads to lower emissions.”

Role of green H₂ in energy storage

CHP must be viewed in combination with renewable energies in sector-coupled, integrated solutions. Its potential can be seen in Power-to-Fuel technology, where excess renewable energy is converted to hydrogen or another type of synthetic fuel. This technology allows energy to be stored and transported cost-effectively.

Explaining the future potential of CHP generation, Jan Andersson, Market Development Manager of the Finnish company Wärtsilä, said, “With the stored fuel, thermal CHP plants produce electricity on days without wind or sunshine. These plants ensure stability by feeding additional electricity into the grid when needed. Thanks to Power-to-X technology, CHP plants will play an important role in the energy supply of the future.”

As one of the leading energy system integrators, Wärtsilä has commissioned numerous CHP plants in Germany, including the new CHP plant for the municipal utility company Kraftwerke Mainz-Wiesbaden (KMW), which has an output of more than 100 megawatts (MW).



Aerial image of Kraftwerke Mainz-Wiesbaden AG power plant delivered by Wärtsilä...
Image © Wärtsilä Corporation

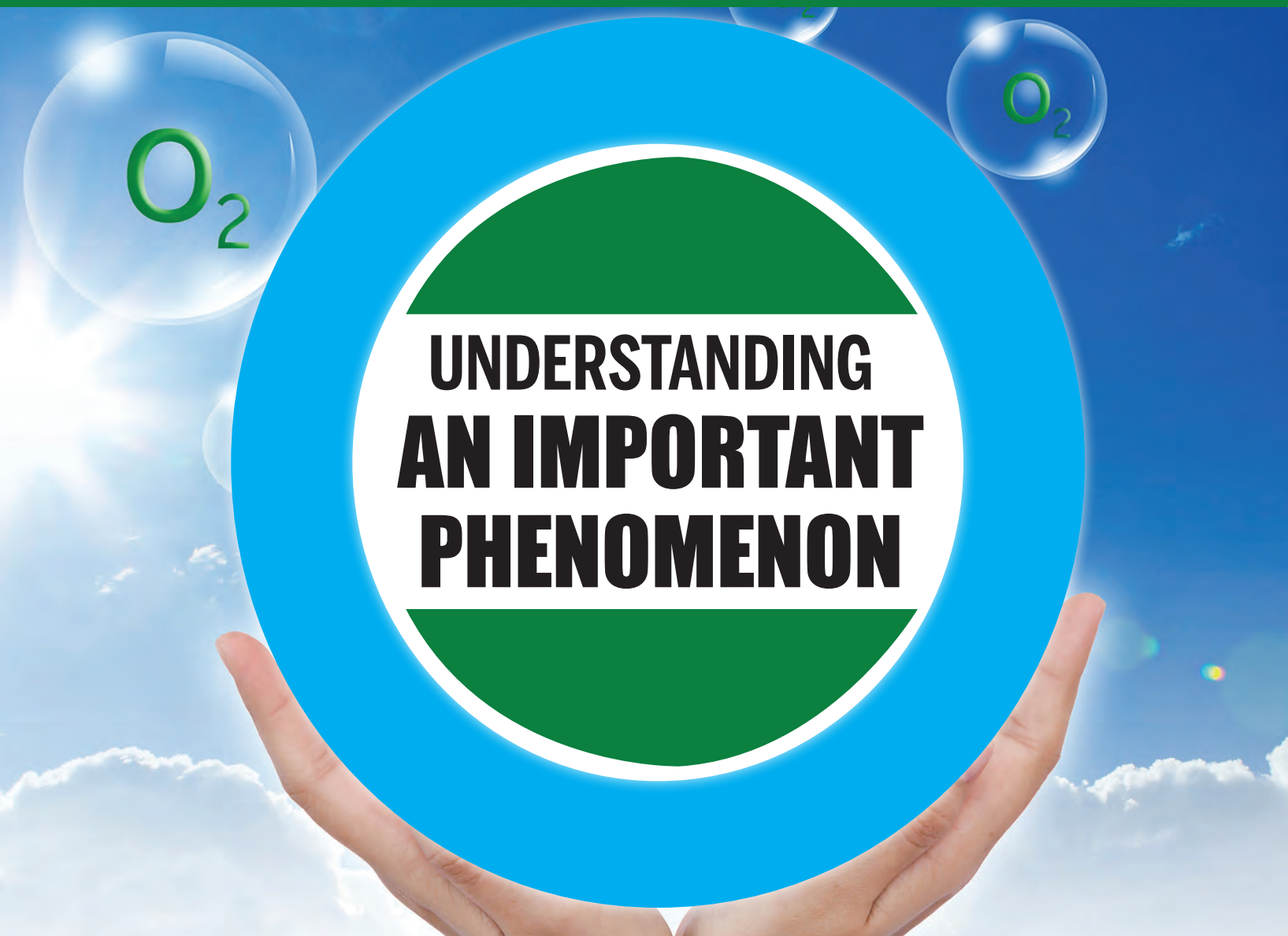
Wärtsilä’s gas motors make up the central element of the power plant. The CHP plant has been designed to serve as a reliable source of power for around 40,000 households in the Mainz-Wiesbaden region, outputting 100 MW of electrical power and around 90 MW of thermal power. The plant has been officially handed over for commencement of commercial operations in April this year.

Contextually, as part of its climate action plan, the German government has committed to increasing the share of electricity produced by CHP plants to 25% of the total electricity production by 2025. Germany, like the European Union, aims to become greenhouse gas neutral by 2050. It has set the preliminary target of cutting emissions by at least 55% by 2030 compared to 1990 levels.

Virtual power plants play an important part in providing control reserve from renewable energies such as biogas, Power-to-X and CHP plants. Citing an example of the utility of CHP plants, Jochen Schwill, Founder and CEO of Next Kraftwerke, said, “CHP plants can help balance out fluctuations caused by volatile renewable energy by feeding power into the grid, producing either more or less electrical energy at short notice. To this end, we provide local forecasts of the generation of energy from renewable sources and the utilization level of the natural gas grid. Together with the operators, we then sell the flexibility offered by CHP plants on the electricity balancing market for a profit.”

CHP and hydrogen

The key technologies for electrification and renewable energy production are consistently becoming more cost-effective and enabling a transformation of power supply towards a decentralized structure. This development is a much stronger driver for the decarbonization of the energy system than the time-consuming expansion of large infrastructures. CHP plants are increasingly being fuelled by green hydrogen, and comprehensive sector coupling is being used to supply districts as climate-neutrally as possible. CHP is hydrogen-ready according to the reports from the Bundesverband Kraft-Wärme-Kopplung (B.KWK), Germany’s Federal Association for CHP Systems. Operating plants with mixed gas containing a 10% hydrogen admixture is no problem for modern CHP plants. Pure hydrogen can be used in fuel cells and there are already some CHP plants that can run on 100% hydrogen.



Although it was known that the oxygen atoms escape from the group of particles inside the electrodes of a li-ion battery because of the back and forth motion of the lithium ions, there was no experimental evidence to support the assumptions on how exactly this happens. A new research work has now opened the door to this important area...

Today, lithium-ion batteries in different sizes and shapes find application in almost all spheres of life. However, complaints regarding their loss of full voltage capability with passage of time are also quite common. A team of researchers from the (US) Department of Energy's SLAC National Accelerator Laboratory and Stanford University had been conducting a thorough investigation on the cause of such voltage sap, what they finally found contradicts some of the assumptions scientists had made about this process and could suggest new ways of engineering electrodes to prevent it.

The phenomenon

When lithium ions flow in and out of a battery electrode during charging and discharging, a tiny bit of oxygen seeps out and the battery's voltage – a measure of how much energy it delivers – fades an equally tiny bit. The losses mount over time, and can eventually sap the battery's energy storage capacity by 10-15%.

These researchers have measured this super-slow process with unprecedented detail, showing how the holes, or vacancies, left by escaping oxygen atoms change the electrode's structure and chemistry and gradually reduce how much energy it can store.

Describing their observation, Peter Csernica, a Stanford PhD student, who worked on the experiments with Associate Professor Will Chueh, said, "We were able to measure a very tiny degree of oxygen trickling out, ever so slowly, over hundreds of cycles. The fact that it's so slow is also what made it hard to detect."

Gist of the observation

Lithium-ion batteries work like a rocking chair, moving lithium ions back and forth between two electrodes that temporarily store charge. Ideally, those ions are the only things moving in and out of the billions of nanoparticles that make up each electrode. But researchers have known for some time that oxygen atoms leak out of the particles as lithium moves back and forth.

While giving a quantitative idea, Csernica said, "The total amount of oxygen leakage, over 500 cycles of battery charging and discharging, is 6%. That's not such a small number, but if you try to measure the amount of oxygen that comes out during each cycle, it's about one one-hundredth of a percent."

The approach of the researchers

In this study, researchers measured the leakage indirectly, instead by looking at how oxygen loss modifies the chemistry and structure of the particles. They tracked the process at several length scales – from the tiniest nanoparticles to clumps of nanoparticles to the full thickness of an electrode.

Because it's so difficult for oxygen atoms to move around in solid materials at the temperatures

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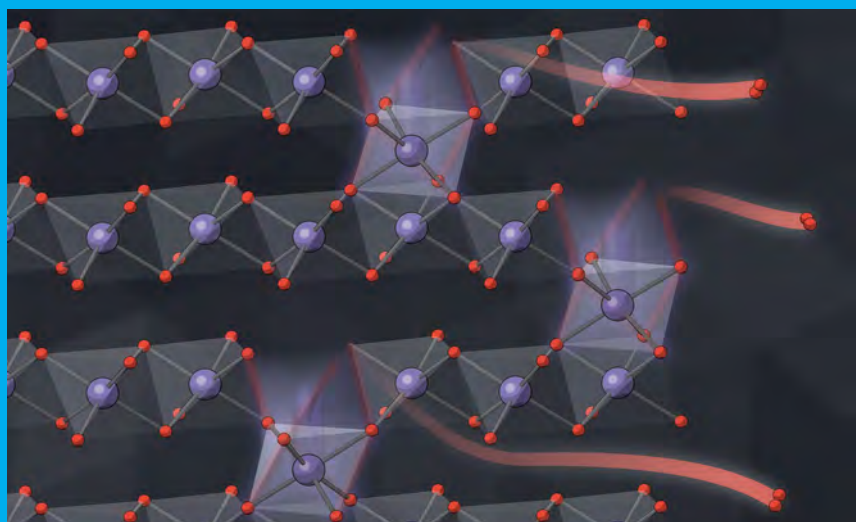
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Scientists at SLAC and Stanford have made detailed measurements of how oxygen seeps out of the billions of nanoparticles that make up lithium-ion battery electrodes, degrading the battery's voltage and energy efficiency over time. In this illustration, the pairs of red spheres are escaping oxygen atoms and purple spheres are metal ions. This new understanding could lead to new ways to minimize the problem and improve battery performance. (Greg Stewart/SLAC National Accelerator Laboratory)

where batteries operate, the conventional wisdom has been that the oxygen leaks come only from the surfaces of nanoparticles, Chueh informed, although this has been up for debate.

To get a closer look at what's happening, the research team cycled batteries for different amounts of time, took them apart, and sliced the electrode nanoparticles for detailed examination at Lawrence Berkeley National Laboratory's Advanced Light Source. There, a specialized X-ray microscope scanned across the samples, making high-res images and probing the chemical makeup of each tiny spot. This information was combined with a computational technique called ptychography to reveal nanoscale details, measured in billionths of a meter.

Meanwhile, at SLAC's Stanford Synchrotron Light Source, the team shot X-rays through entire electrodes to confirm that what they were

seeing at the nanoscale level was also true at a much larger scale.

Comparison leading to conclusion

Comparing the experimental results with computer models of how oxygen loss might occur, the team concluded that an initial burst of oxygen escapes from the surfaces of particles, followed by a very slow trickle from the interior. Where nanoparticles glommed together to form larger clumps, those near the center of the clump lost less oxygen than those near the surface.

Another important observation that Chueh explained is – how the loss of oxygen atoms affects the material they left behind. He said, "That's actually a big mystery. Imagine the atoms in the nanoparticles are like close-packed spheres. If you keep taking oxygen atoms out, the whole thing could crash down and densify, because the structure likes to stay closely packed."

Since this aspect of the electrode's structure could not be directly imaged, the scientists again compared other types of experimental observations against computer models of various oxygen loss scenarios. The results indicated that the vacancies do persist – the material does not crash down and densify – and suggest how they contribute to the battery's gradual decline.

Delivering an insight of the phenomenon, Chueh said, "When oxygen leaves, surrounding manganese, nickel and cobalt atoms migrate. All the atoms are dancing out of their ideal positions. This rearrangement of metal ions, along with chemical changes caused by the missing oxygen, degrades the voltage and efficiency of the battery over time. People have known aspects of this phenomenon for a long time, but the mechanism was unclear."

Now, he added, "We have this scientific, bottom-up understanding" of this important source of battery degradation, which could lead to new ways of mitigating oxygen loss and its damaging effects.

Chueh is an investigator with the Stanford Institute for Materials and Energy Sciences (SIMES) at SLAC. The Advanced Light Source, Stanford Synchrotron Radiation Lightsource and Spallation Neutron Source at Oak Ridge National Laboratory, where parts of this work were performed, are DOE Office of Science user facilities. Major funding came from the DOE Office of Energy Efficiency and Renewable Energy, Vehicle Technologies Office, and samples were provided by the Samsung Advanced Institute of Technology Global Research Outreach program.

BI

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INTRICACIES OF LIGHTNING

PART-1

Earthing is primarily provided to electrical or electronic systems to offer an alternative route for the flow of leakage currents. The objective is safety. However, proper earthing is very essential to protect people and property from lightning. How to design that?

Lightning, the visible discharge of electricity that occurs when a region of a cloud acquires an excess electrical charge, either positive or negative, that is sufficient to break down the resistance of air. Lightning is a naturally occurring electrostatic discharge during which two electrically charged regions in the atmosphere or ground temporarily equalize themselves, causing the instantaneous release of as much as one gigajoule of energy. This discharge may produce a wide range of electromagnetic radiation, from very hot plasma created by the rapid movement of electrons to brilliant flashes of visible light in the form of black-body radiation. Lightning causes thunder, a sound from the shock wave that develops as gases in the vicinity of the discharge experience a sudden increase in pressure. Lightning occurs commonly during thunderstorms and other types of energetic weather systems, but volcanic lightning can also occur during volcanic eruptions.

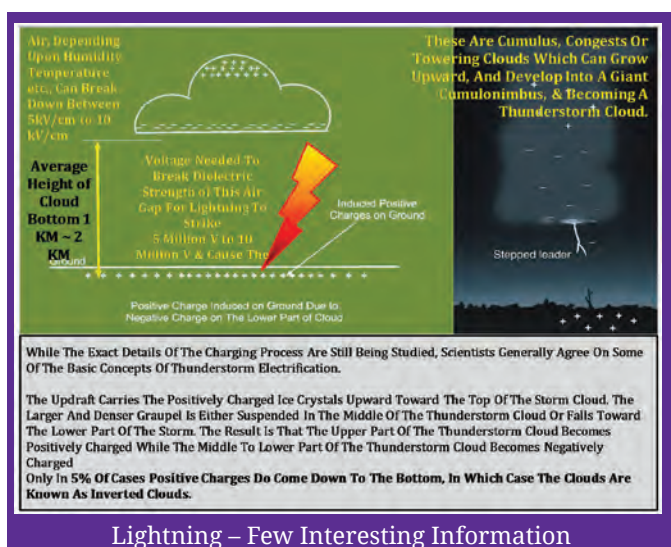
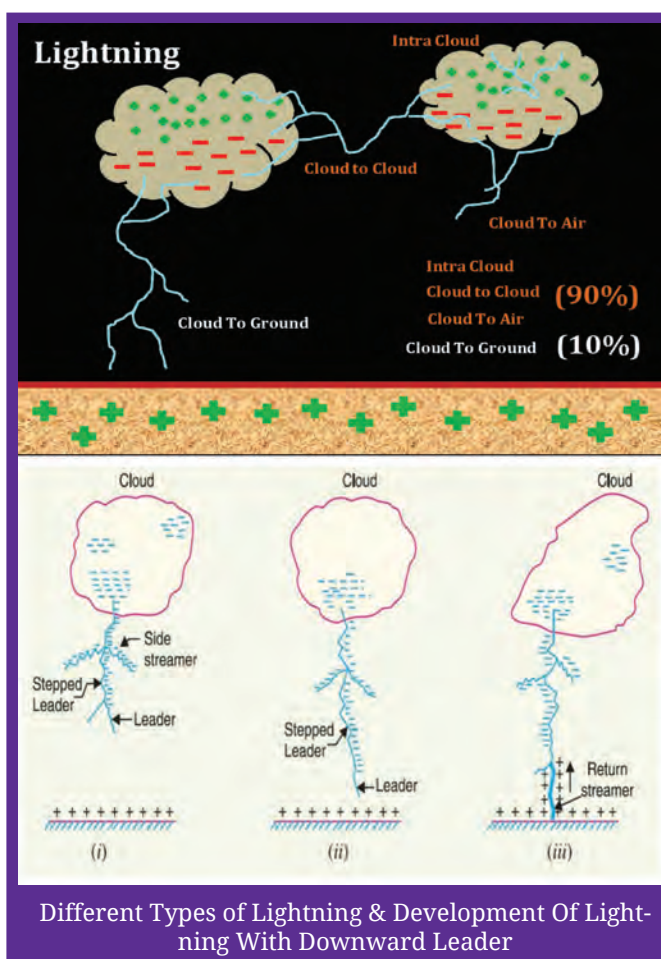
Lightning is a very common event in nature. At any one time, there are some 1700 electrical storms active throughout the world, producing in excess of 100 flashes per second. This equates to an aggregate of some 7 to 8 million flashes per day. Of these, approximately 90% are cloud-to-cloud flashes and the remaining are predominately cloud-to-ground flashes. It is a natural phenomenon where the charge generated due to cloud/ air movement and other turbulent atmospheric conditions. When these is separated charged clouds get very large, the air between the positive and negative regions breaks down in a giant spark (an intra-cloud stroke), or a charged region breaks down to ground (a cloud ground stroke). The resulting current being extremely high (it can vary from 30 kA to 100 kA and may sometimes even scale up to 450 kA) ionizes and heats the air along the path to $\sim 30,000$ DegC. The ionized air glows brightly (the lightning), and the sudden increase in temperature expands the channel and nearby air, creating a pressure wave that makes the thunder. Globally approximately 90% of all lightning flashes are cloud-to-cloud & only 10% being cloud-to-ground flashes (in which negative charge is transferred from the cloud to ground).

Ground-to-cloud flashes are extremely rare and generally only occur from high mountain tops or tall man-made structures – they are typically positive strokes (positive lightning). Strokes between clouds are relatively rare.

To be capable of generating lightning, the cloud needs to be 3 to 4 km deep (cumulonimbus), the taller the cloud, the more frequent the lightning is. The center column of the cumulonimbus can have updrafts exceeding 120 km/

Energy/ Power Flow In One Lighting Stroke		
Average Energy Flow/ Stroke of Lightning	10,00,000.00	Joules
Energy Flow/ Stroke in KWh	0.28	KWh
Approx. Duration of Lightning (10/350 μ s waveform)	360	μ s
Power Stroke Of Lightning In Its Existance (360 μ s)	2.78	GW

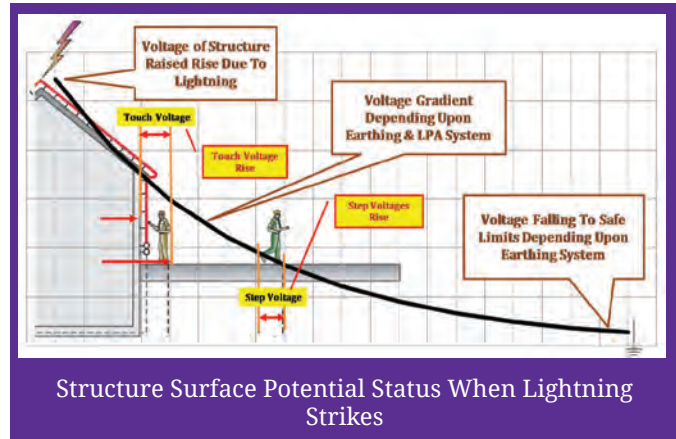
hr, creating intense turbulence with violent wind shears and consequential danger to aircraft. This same updraft gives rise to an electric charge separation that ultimately leads to the lightning flash.



Need of Lightning Protection System (LPS)

But the big question is, if lightning is a natural phenomenon and is inevitable, why to invest in a safety system to handle this? Why not just let the lightning strike as it may and let the building dissipate the energy to ground?

To understand it, we must understand the Lightning first. Lightning is nothing but a discharge of atmospheric electricity, which is generated by an accumulation of differing charges within a cloud. It is one of the most common causes of weather-related deaths in India. Apart from causing deaths each year lightning strikes cause crore of monetary losses in property damage and devastation. Because of sheer intensity & short duration for which lightning current flows, the related energy has high level of damaging power severity, despite the fact that it flows for a few μ seconds. It is well recorded that an average lightning strike may contain energy up to 1 Billion Joules and the core temperature of a lightning strike is approximately 30,000 DegC, which in normal energy consumption terms is only about 300 kWh – but since the lightning current has very short average time ($\sim 350 \mu$ s or so), the energy flow per unit of time (i.e. power burst or rate of energy flow) becomes too large (approx. 800 kW). Such large power flow has a massively destructive impact on the structure or any live body, be it human or animal, through which it flows. The precise details of such impacts can never be predicted however, in humans or animals, it can damage the central nervous system, heart, lungs, and other vital organs (like any other electrical shock leading to even deaths in most of the cases. Buildings, structures and power lines may get affected by the excessively high voltages, intense electromagnetic forces and heat, getting generated by electromagnetic forces when lightning current passes through the structure. The rise system id voltage of electrical power supply may also damage house wiring or appliances & may also start the fire indirectly by causing power faults (short circuit or wire burning). The non-availability or poorly designed LPS will also not limit the rise in surface potential (see pic below)

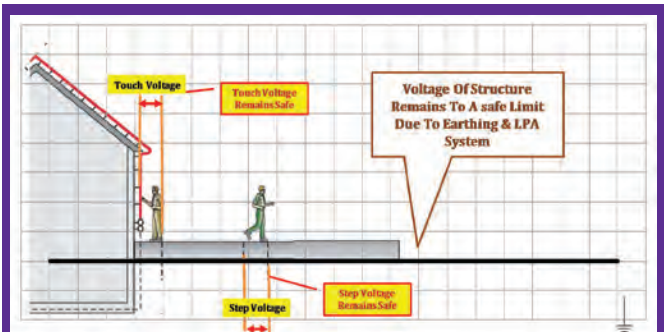
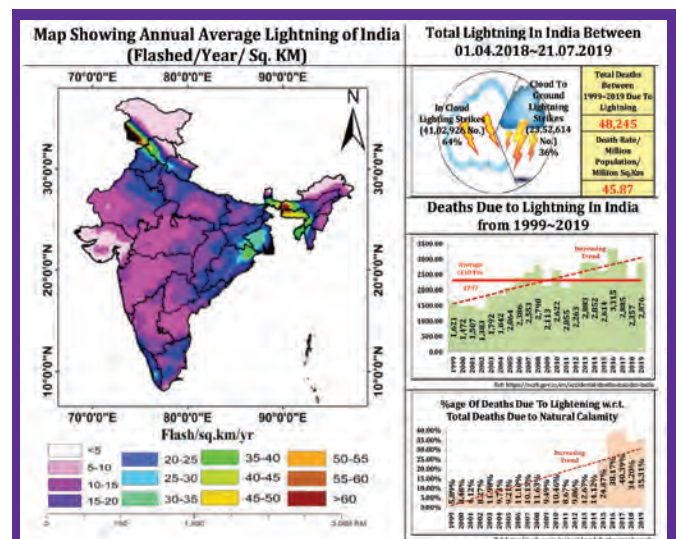


creating an unsafe condition leading to unsafe surroundings and may cause loss of lives.

Life Loss Due to Lightning in India

As per Mid Monsoon 2019 Lightning Report By Indian Meteorological Department, between 01.04.2018 to 31.07.2019, there were a total of 64,55,540 lightning strikes, out of which 23,52,614 (36%) were cloud to ground lightning while rest of 41,02,926 (64%) were In-Cloud (IC) lightning strike (See graphs below).

According to the data analyzed by the Indian Institute of Tropical Meteorology (IITM), Pune, on 16.04.2018 there were almost 41,000 clouds to ground (CG) lightning strikes all over India, in which about 89 people in 11 states were killed. The data from 1999 from the reports of National Crime Records Bureau, MoHA (Accidental Deaths & Suicide in India) shows an alarming trend of deaths by lightning in absolute numbers and more steeper in percentage of deaths due to natural calamities.



Structures' Surface Potential Status Under Normal Conditions

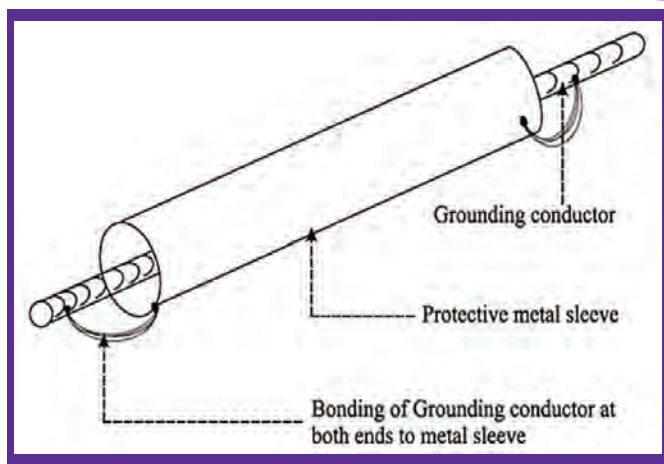
The percentage rise probably proves that despite the good work of National Disaster Management Program, though India could reduce the number of deaths due to other natural calamities, the deaths by lightning has remained at the same level. Hence there is a greater need to understand the Lightning phenomenon, and spread awareness to put a proper LPS, in all places in order to have a much safer social environment in which we are able to save more lives when lightning strikes. It is important to note here that as of now there is no formal system in India to account & record property losses due to lightning.

Lightning Protection System (LPS)

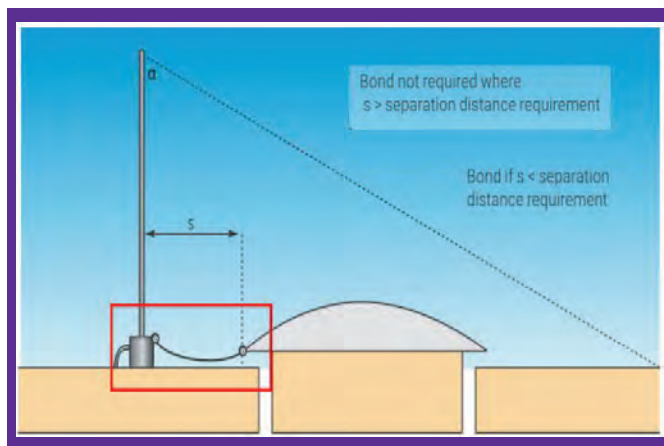
The purpose of a LPS is to safely direct the lightning current with intense electrical energy, travelling from the clouds to the ground after breaking the natural barrier of atmosphere. The system must be designed to make an isolated & safe conducting path with the lowest possible electrical resistance in order to guide the lightning current to ground, so as to reduce its impact on nature, infrastructure and/ or human/ animal lives.

Although any LPS cannot guarantee a 100% protection and at best can only avoid loss of lives and damage to infrastructures to a certain extent if lightning strikes yet a well-planned LPS would certainly help in reducing its impact (and in eliminating in some cases), along with meeting the basic purpose of saving lives. However, it may be noted that when a lightning strikes a structure, its electrical potential with respect to earth is also raised (see the picture) and thus the lightning current, while travelling down through the LPS, may seek alternative paths during this travel through anything where it finds lower resistance to ground leading side-flashing. To avoid this, IS: 2309 1989 strongly recommends reduction of the resistance to earth to a value below 10 Ohm to help in reducing the potential gradient around the earth electrodes to reduce the risk of side-flashing to metal in or on a structure. For this the IS: 2309 1989 recommends two different ways of preventing side flashing, namely: a) isolation, and b) bonding as described below:

- **Isolation:** Isolation requires either providing a large gap or providing an insulation between the LPS Conductor and any nearby metal structures (e.g. water or other services) to ensure it does not get connected to any other metal objects connected with ground.



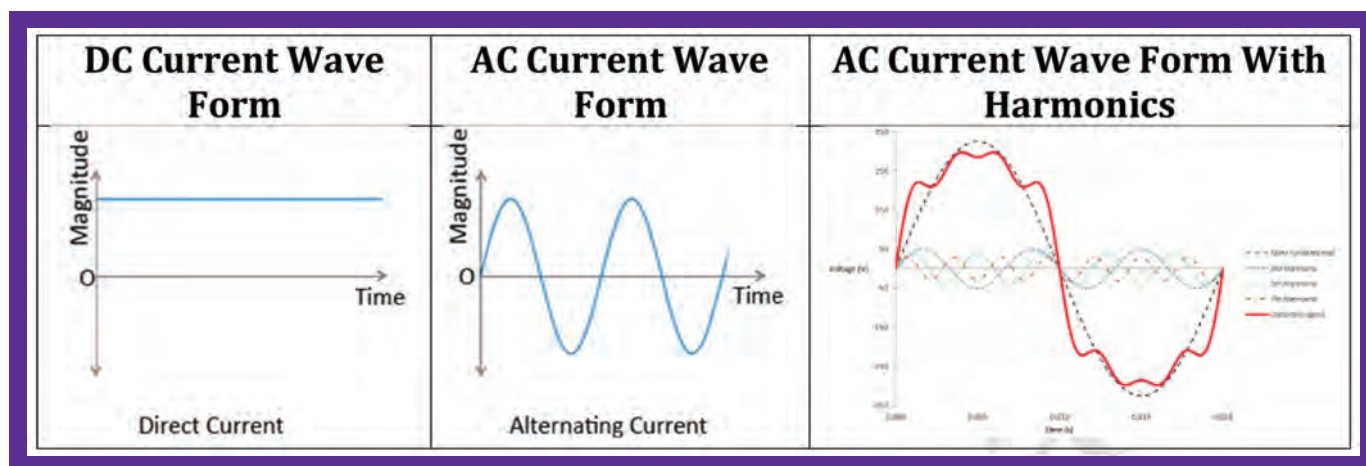
- **Bonding:** In bonding, adjacent metal works need to be connected with LPS (so that the lightning does get diverted to them) with careful consideration of possible effects of such bonding that it might have upon metalwork which has been protected.



Lightning Flash/ Current

Almost everybody is aware of the two most common waveforms of electricity as shown – while DC waveform remains at fixed level depending upon the level of current flowing in circuit, the AC current has sinusoidal wave form whose amplitude shows the amount of current flowing however when many harmonics get mixed in AC Current the wave form also gets distorted.

However, it has been a challenge for researchers to arrive at the wave form of Lightning current, because of its highly short duration of existence & transient nature due to which the shape of the lightning current may vary from event to event, place to place. Still for study and application purposes, based on statistical probability, the researchers have defined a wave shape of these lightning currents.



Understanding Wave Form of Lightning Current

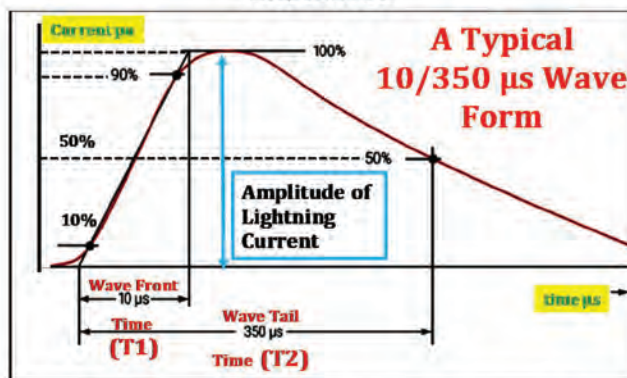
One of the most fundamental requirements of any concept of protection is to define the nature of the hazard. Lightning is one of its kind, an uncontrolled natural phenomenon, which is a variability so high that giving its definition is not easy. In order to be able to test protection networks and provide comparison data, various standard waveforms have been proposed over the years. These are all defined in terms of magnitude and wave shape, and can refer to current (normally associated with short-circuit conditions) or voltage (associated with open-circuit faults). Waveforms are usually double exponential rise and decay shapes, specified by two time periods; rise-time to peak value and decay-time to 50% peak value. The wave form is defined as T1/T2 μ s waveform where T1 refers to Wave Front Time (μ s) & is the time taken by current to achieve 90% of its peak value while T2 refers to Wave Tail Time (μ s) & is time taken by the current to diminish down to 50% of that peak value.

The lightning is a very short burst of voltage and as such no accurate waveform for these currents can be defined (even mathematically), however based on statistical data of numerous measurements of actual lightning strikes, researchers have arrived at conclusion that the 10/350 μ s waveform is a reasonable approximation for the current waveform for the primary lightning stroke. IEC 60060-2 describes a particular method of determining slopes by choosing the 10/350 μ s waveform to represent the electrical and mechanical stress associated with direct conducted lightning.

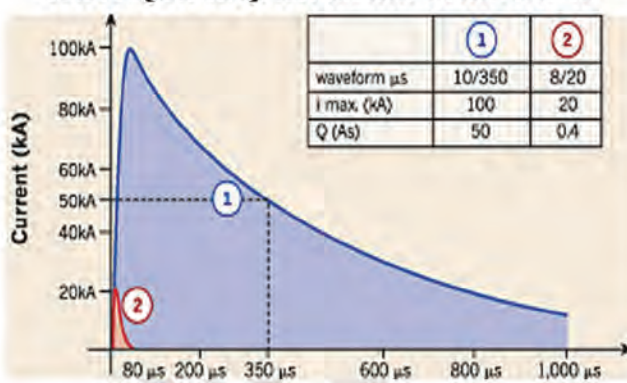
Both the IEC and the IEEE have standardized on two types of current wave forms:

- 10/350 μ s waveform to represent direct lightning stroke
- 8/20 μ s waveform to represent induced lightning stroke

A 10/350 μ s Lightning Wave Form Explained



10/350 μ s Wave (100 kA) & 8/20 μ s Wave (20 kA) On Same Time Scale



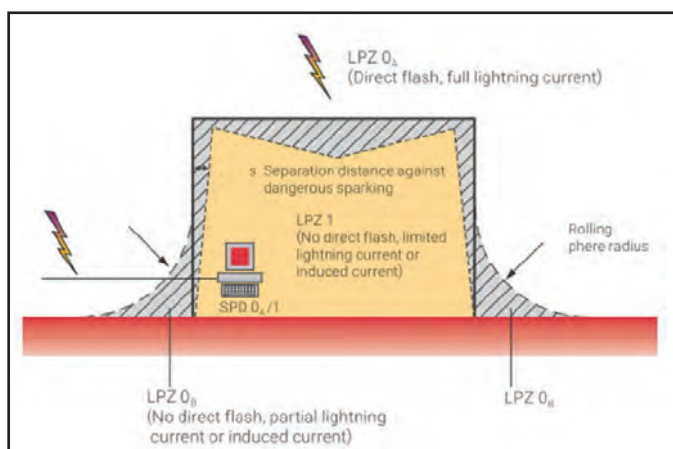
Risk Assessment & Threat Exposure from Lightning

Detailed programs are available for risk assessment for designing the LPS, however they all are based on following 10 sets of losses/ risks categories:

Risk Assessment		
Loss	Risk To Structure	Risk To Services
L1-Loss Of Human Life	R1-Risk Of Loss Of Human Life	
L2-Loss Of Essential Services	R2-Risk Of Loss Of Essential Services	R'2-Risk Of Loss Of Essential Services
L3-Loss Of Cultural Heritage	R3-Risk Of Loss Of Cultural Heritage	
L4-Economic Loss	R4-Risk Of Economic Loss	R'4-Risk Of Economic Loss

Maximum Current Levels For Lightning Protection Levels I To IV And Probability Of Exceeding These Levels				
Protection Category	LPL I	LPL II	LPL III	LPL IV
Protection Level				
Maximum Peak Current (of 10/350 μ s Wave)	200 kA	150 kA	100 kA	100 kA
Probability of Current Becoming Greater	1%	2%	3%	3%

Lighting Protection Zone (LPZ)	Exposure Threats		
	Lighting Flash	Lightning Current Or Induced Current	Electro Magnetic Field
LPZ O _A	Yes	Full	Full
LPZ O _B	No	Partial	Full
LPZ 1	No	Limited	Partial
LPZ 2	No	Reduced below LPZ 1	Reduced below LPZ 1



Lightning protection level (LPL) is a number assigned to represent maximum and minimum lightning parameters that should not be exceeded by natural lightning. While LPL I offers the highest protection level (greatest level of protection), with LPL IV offering the lowest level of protection as shown below:

Minimum Current Levels (Related To Interception Efficiency) For Lightning Protection Levels I To IV				
Head	Highest Safety -----> Lowest Safety			
	LPL I	LPL II	LPL III	LPL IV
Minimum Current Levels (Related to Interception Efficiency)	3kA	5kA	10kA	16kA
Probability Current Is Greater Than Minimum	0.99	0.97	0.91	0.84
Rolling Sphere Method-Radius	20m	30m	45m	60m
Mesh Method-Mesh Size	5m x 5m	10m x 10m	15m x 15m	20m x 20m
Protection Angle Method	Distance Air Terminations (Distances in Brackets Are the Grid Distances for Protective Angle Method)			
Height of Rod (0.5m)	8.8m (6.2m)	10.9m (7.7m)	13.3m (9.4m)	15.4m (10.9m)
Height of Rod (1.0m)	12.4m (8.8m)	15.3m (10.8m)	18.8m (13.3m)	21.8m (15.4m)
Height of Rod (1.5m)	15.2m (10.7m)	18.7m (13.2m)	23.0m (16.2m)	26.6m (18.8m)
Height of Rod (2.0m)	17.4m (12.3m)	21.5m (15.2m)	26.5m (18.7m)	26.6m (18.8m)

For example, LPL I positions terminals have the probability that 99% of all lightning flashes are intercepted (all those of 3 kA or greater). There is only a 1% probability that lightning may be smaller than the 3 kA minimum, and may not be close enough to an air-terminal to be intercepted. It should be noted that flashes of less than 3 kA are rare, and typically would not be expected to cause damage to the structure.

The table also gives details the rolling sphere radius used in the rolling sphere design method (which is the most preferred method for determining positioning of air-terminals) as well mesh sizes for the mesh methods for designing LA protection system. There is one method known angle method. ...to be continued



Prabhat Khare possesses a BE (Electrical) degree from IIT Roorkee (Gold Medalist). Now, he is the Director of KK Consultants. He is also a BEE Certified Energy Manager and a Lead Assessor for ISO 9K, 14K, 45K & 50K.

Thermography that is Smart & Networked

In contracting as well as in the industrial sector, you profit considerably from the use of a thermal imager:

- You carry out status-oriented servicing work and prevent expensive system downtimes.
- You overcome the limitations of a pyrometer by measuring not just individual points but whole surfaces.
- You deal with jobs such as preventive maintenance of high voltage systems, circuit breakers or mechanical components on plants more quickly than before, thus saving time and money.
- You always provide best quality and ensure the satisfaction of your management or your customers – for example by testing and impressively presenting the faultless fitting or the functionality of system.

Convincing features

- **High resolution and image quality:** Up to 320 x 240 pixels – with testo SuperResolution, even up to 640 x 480 pixels. Image quality and resolution are ideal for all applications in both contracting and industry.
- **Connection to App and other Testo measuring instruments:** Create and send compact reports on site with the testo Thermography App. Transfer the measurement values of the testo 605i hygrometer and the clamp meter testo 770 wirelessly to the imagers, in order to identify mould/humidity related danger or to complement thermal images with current/voltage values. For example – in solar panels.
- **Automatic setting of emissivity:** The testo ε -Assist



Bluetooth & Wi-Fi Thermal Imager- testo 872...



function automatically sets the emissivity and temperature of the measurement object, thus facilitating precise thermography.

- **Objectively comparable images:** testo ScaleAssist adapts the thermal image scale to the inner and outer temperatures of the measurement object, and the difference between them. This ensures comparable and error-free thermal images of the thermal insulation behaviour of a building.

Smart & networked way

testo thermal imager 872 can also be connected to the testo Thermography App. The App, available for iOS and Android, turns the user's smartphone into a second display and a remote control for the thermal imager, and serves to create compact reports quickly on site, to save them online and send them by e-mail. Apart from this, the App offers useful tools for fast analysis on site – for example for inserting additional measurement points, determining the temperature development via a line or

adding comments to a thermal image. Also very useful: With the App you can transmit thermal images live to your smartphone/tablet, and can use it as a second display.

Connectivity

testo 872 thermal imager can be additionally connected wirelessly with the thermohygrometer testo 605i and the clamp meter testo 770-3.



Free Thermography App...

The measurement values of both compact measuring instruments are transmitted to the imagers by Bluetooth. This allows fast and clear identification of where exactly the thermography is to be done in any given climatic condition or at what load a switching cabinet is running.

Testo India

With more than 60 years of measurement experience, Testo SE & Co. KGaA is headquartered in Titisee, Germany. Testo India Pvt. Ltd., a 100% subsidiary of Testo SE & Co. KGaA is headquartered in Pune with its pan-India network. 

Courtesy: Testo India Pvt. Ltd.

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ALL INDIA INSTALLED CAPACITY (IN MW) OF POWER STATIONS
(As on 31.06.2021)

Region	Ownership/ Sector	Mode wise breakup								Grand Total
		Thermal					Nuclear	Hydro	RES * NRE)	
		Coal	Lignite	Gas	Diesel	Total				
Northern Region	State	16659.00	250.00	2879.20	0.00	19788.20	0.00	5888.25	725.51	26401.96
	Private	22425.83	1080.00	558.00	0.00	24063.83	0.00	2916.00	18630.13	45609.96
	Central	15662.48	250.00	2344.06	0.00	18256.54	1620.00	11484.52	379.00	31740.06
	Sub Total	54747.31	1580.00	5781.26	0.00	62108.57	1620.00	20288.77	19734.64	103751.98
Western Region	State	21500.00	900.00	2849.82	0.00	25249.82	0.00	5446.50	569.28	31265.60
	Private	32847.17	500.00	4676.00	0.00	38023.17	0.00	481.00	29131.62	67635.79
	Central	20133.00	0.00	3280.67	0.00	23413.67	1840.00	1635.00	666.30	27554.97
	Sub Total	74480.17	1400.00	10806.49	0.00	86686.66	1840.00	7562.50	30367.20	126456.36
Southern Region	State	20322.50	0.00	791.98	159.96	21274.44	0.00	11774.83	592.88	33642.15
	Private	12747.00	250.00	5340.24	273.70	18610.95	0.00	0.00	43702.97	62313.92
	Central	11835.02	3390.00	359.58	0.00	15584.60	3320.00	0.00	541.90	19446.50
	Sub Total	44904.52	3640.00	6491.80	433.66	55469.99	3320.00	11774.83	44837.75	115402.57
Eastern Region	State	7450.00	0.00	100.00	0.00	7550.00	0.00	3537.92	275.11	11363.03
	Private	6153.00	0.00	0.00	0.00	6153.00	0.00	209.00	1310.19	7672.19
	Central	13499.48	0.00	0.00	0.00	13499.48	0.00	1005.20	10.00	14514.68
	Sub Total	27102.48	0.00	100.00	0.00	27202.48	0.00	4752.12	1595.30	33549.90
North Eastern Region	State	0.00	0.00	466.36	36.00	502.36	0.00	422.00	233.25	1157.60
	Private	0.00	0.00	24.50	0.00	24.50	0.00	0.00	122.15	146.65
	Central	770.02	0.00	1253.60	0.00	2023.62	0.00	1522.00	30.00	3575.62
	Sub Total	770.02	0.00	1744.46	36.00	2550.48	0.00	1944.00	385.40	4879.87
Islands	State	0.00	0.00	0.00	40.05	40.05	0.00	0.00	5.25	45.30
	Private	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.87	24.87
	Central	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.10	5.10
	Sub Total	0.00	0.00	0.00	40.05	40.05	0.00	0.00	35.22	75.27
ALL INDIA	State	65931.50	1150.00	7087.36	236.01	74404.86	0.00	27069.50	2401.27	103875.64
	Private	74173.00	1830.00	10598.74	273.70	86875.45	0.00	3606.00	92921.93	183403.38
	Central	61900.00	3640.00	7237.91	0.00	72777.91	6780.00	15646.72	1632.30	96836.93
	Total	202004.50	6620.00	24924.01	509.71	234058.22	6780.00	46322.22	96955.51	384115.94

Figures at decimal may not tally due to rounding off

Source: CEA



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3 YEARS	18	2000.00	2900.00	3500.00	2000.00	3900.00	4500.00
5 YEARS	30	3000.00	4500.00	5500.00	3000.00	6000.00	7000.00
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3 YEARS	18	3200.00	4100.00	4700.00	3200.00	5100.00	5700.00
5 YEARS	30	4800.00	6300.00	7300.00	4800.00	7800.00	8800.00



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Ranking as Climate Protection Pioneer

HARTING has been a member of the nationwide pioneering initiative of Climate Protection Companies for a total of ten years. Now, the technology group has been honoured for its commitment by the Federal Environment Ministry (BMU), the Federal Ministry of Economics (BMWi) and the Association of German Chambers of Industry and Commerce (DIHK)...



Grid failure operation Dr. Stephan Middelkamp, General Manager Quality and Technologies at the HARTING Technology Group, with the award...

At HARTING, climate protection and production go hand in hand. “Ecological responsibility is a fundamental component of our actions”, is the motto of their corporate philosophy. Accordingly, the technology group sources 100% renewable energy at all its locations in Germany. The technology group is operating four combined heat and power plants harnessing biomethane, of which three have been upgraded to combined heat, power and cooling (CHCP) plants. The worldwide photovoltaic capacity stands at around 1.89 MW_{peak}. Overall, HARTING has saved an average of around 18,500 tons of CO_{2eq} annually since the 2011/12 financial year.

“In the development of our products and solutions, climate protection is always one of our key concerns. After all, secure, consistent and efficient connectivity

is essential in realising CO₂ savings be realised across the entire value chain, thereby making significant contributions to achieving the climate relevant targets,” says Dr. Stephan Middelkamp, General Manager Quality and Technologies at the HARTING Technology Group.

For the HARTING Technology Group, environmental and climate protection has been an integral part of its daily business since 1996. Increasing energy efficiency and environmentally friendly management are parts of HARTING’s corporate philosophy. An internal environmental protection award was introduced as early as in 1989.

The Espelkamp-based family business received the official certification as a “climate protection company” in July 2011 and was thereby honoured for its exceptional achievements in climate protection and energy efficiency.



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Advancing developments: igus honoured as SPE Network Pioneer Member

igus now also offers fully harnessed cables for Single Pair Ethernet technology, especially for use in e-chains...

Single Pair Ethernet is currently one of the biggest trend topics in the field of data communication in order to be able to communicate with even the smallest sensors. In addition to compact connectors, slim cables are also in demand. For this purpose, igus has developed a highly flexible Single Pair Ethernet cable especially for dynamic use in the energy chain, and now also offers it harnessed as a ready-to-connect and tested readycable. To further advance the research of the technology, igus joined the SPE Industrial Partner Network in 2019 and has now received the "PIONEER Member" award.

Single Pair Ethernet - also known as SPE for short - has been on everyone's lips since 2019. A lot of hope lies in the new compact data technology, which the industry now wants to harness in order to enable Ethernet-based communication with even the smallest sensors or cameras. One of two networks driving SPE research is the SPE Industrial Partner



Network. Together with six other members, connector specialist Harting founded the network in 2019. Shortly afterwards, igus joined as a partner for the dynamic use of cables. The motion plastics specialist has now received the Pioneer Member Award for this collaboration. "We have been working with Harting on various projects for several years.

So, we also got involved quite early in the development of a Single Pair Ethernet cable that is specially designed for use in the energy chain and is compatible with the Harting T1 connector", says Andreas Muckes, Head of Product Management chainflex cables at igus GmbH. "We are looking forward to advancing the technology together with many renowned companies and implementing new applications together in the near future." igus presented the first highly flexible cable for Single Pair Ethernet at SPS 2019.

For further information: E-mail: ralloli@igus.net,
Website: www.igus.in

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