NARAYANA
ENGINEERING COLLEGE
NELLORE (AUTONOMOUS)

ACCREDITED WITH GRADE A+ NAAC

Department of
Electrical and Electronics Engineering

THUNDER TRENDS

Technical Magazine

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Vision of the Institute

To be one of the nation's premier Institutions for Technical and Management Education and a key contributor for Technological and Socio-economic Development of the Nation.

Mission of the Institute

- To produce technically competent Engineers and Managers by maintaining high academic standards, world class infrastructure and core instructions.
- To enhance innovative skills and multi disciplinary approach of students through well experienced faculty and industry interactions.
- To inculcate global perspective and attitude of students to face real world challenges by developing leadership qualities, lifelong learning abilities and ethical values.

Vision of the Department

To impart knowledge in the field of Electrical and Electronics Engineering to meet the technical challenges of industry and society with strong innovative skills, leadership qualities and ethics.

Mission of the Department

- To provide standard training and effective teaching learning process to the students by using the state-of-the-art laboratories, core instruction and efficient faculty.
- To enhance competent, innovative and technical skills amongst the students through training programs by industry and external participation.
- To inculcate leadership qualities, ethical values and lifelong learning skills in learners to serve the society and nation for overall development through value based education.

Program Educational Objectives (PEOs)

Programme Educational Objectives (PEOs) of B.Tech (Electrical and Electronics Engineering) program are: Within few years of graduation, the graduates will

PEO-1: To solve composite problems using mathematics, basic sciences and engineering principles in the domains of testing, design and manufacturing.

PEO-2: To achieve higher positions in their profession by demonstrating leadership qualities, research and innovative abilities.

PEO-3: To contribute in the field of Electrical and Electronics Engineering to finding solutions for societal problems through their lifelong learning skills and ethical values.

Program Outcomes (POs)

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

On completion of the B.Tech. (Electrical and Electronics Engineering) degree, the graduates will be able to

PSO-1: Provide alternate solutions to address the problems with specific requirements in the field of Electrical and Electronics Engineering.

PSO-2: be ready to work professionally in relevant industries like power systems, control systems and software industries.

PROFESSOR DESK

Statistical Review of World Energy The Statistical Review of World Energy is moving.

The challenges and uncertainties facing the global energy system are at their greatest for almost 50 years. bp's Statistical Review of World Energy 2022 reveals that the growing shortages and increasing prices highlight the continuing importance of energy 'security' and 'affordability' alongside 'lower carbon' when addressing the energy trilemma

Energy developments

Primary energy demand increased by 5.8% in 2021, exceeding 2019 levels by 1.3%.

Between 2019 and 2021, renewable energy increased by over 8EJ. Consumption of fossil fuels was broadly unchanged.

Fossil fuels accounted for 82% of primary energy use last year, down from 83% in 2019 and 85% five years ago.

Carbon emissions: Carbon dioxide emissions from energy use, industrial processes, flaring and methane (in carbon dioxide equivalent) rose 5.7% in 2021 to 39.0 GtCO2e, with carbon dioxide emissions from energy rising 5.9% to 33.9 GtCO2, close to 2019 levels.

Carbon dioxide emissions from flaring and emissions from methane and industrial processes rose more modestly by 2.9% and 4.6% respectively.

Oil: Oil consumption increased by 5.3 million barrels per day (b/d) in 2021 but remained 3.7 million b/d below 2019 levels.

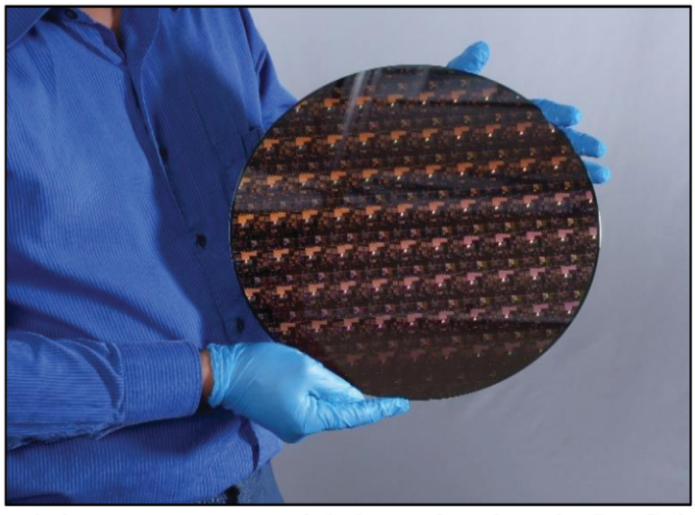
A majority of the consumption growth came from gasoline (1.8 million b/d) and diesel/gasoil (1.3 million b/d). Regionally, most of the growth took place in the US (1.5 million b/d), China (1.3 million b/d) and the EU (570,000 b/d).Global oil production increased by 1.4 million b/d in 2021, with OPEC+ accounting for more than three-quarters of the increase. Among all countries, Libya (840,000 b/d), Iran (540,000 b/d) and Canada (300,000 b/d) saw the largest increases. Nigeria (-200,000 b/d), the UK (-170,000 b/d) and Angola (-150,000 b/d) reported the biggest declines.

Refinery capacity declined for the first time in over 30 years by almost 500,000 b/d last year, driven by a sharp reduction in the OECD (1.1 million b/d). As a result, refining capacity in the OECD in 2021 was at its lowest level since 1998.

Dr. B. AKHIB KHAN
PROFESSOR, EEE , NECN

February 2021 -IBM unveils the world's first 2-Nanometer chip Technology, which could improve

Tesla acquired a former JC Penney's distribution centre in Lathrop, California, in 2021 for a new battery plant called the Mega factory, with a target capacity of 40 GWh/year when finished. The next-generation Megapacks is planned to use prismatic lithium iron phosphate batteries.



performance and reduce power consumption in electronic devices.

IBM (NYSE: IBM) unveiled a breakthrough in semiconductor design and process with the development of the world's first chip announced with 2 nanometre (nm) nanosheet technology.

Semiconductors play critical roles in everything from computing, to appliances, to communication devices, transportation systems, and critical infrastructure.

"The IBM innovation reflected in this new 2 nm chip is essential to the entire semiconductor and IT industry."Demand for increased chip performance and energy efficiency continues to rise, especially in the era of hybrid cloud, AI, and the Internet of Things. IBM's new 2 nm chip technology helps advance the state-of-the-art in the semiconductor industry, addressing this growing demand. It is projected to achieve 45 percent higher performance, or 75 percent lower energy use, than today's most advanced 7 nm node chips.

The potential benefits of these advanced 2 nm chips could include:

1. Quadrupling cell phone battery life, only requiring users to charge their devices every four days.

2. Slashing the carbon footprint of data centres, which account for one percent of global energy use. Changing all of their servers to 2 nm-based processors could potentially reduce that number significantly.

3. Drastically speeding up a laptop's functions, ranging from quicker processing in applications, to assisting in language translation more easily, to faster internet access.

4. Contributing to faster object detection and reaction time in autonomous vehicles like self-driving cars. "The IBM innovation reflected in this new 2 nm chip is essential to the entire semiconductor and IT industry," said Darío Gil, SVP and Director of IBM Research.

"It is the product of IBM's approach of taking on hard tech challenges and a demonstration of how breakthroughs can result from sustained investments and a collaborative R & D ecosystem approach."

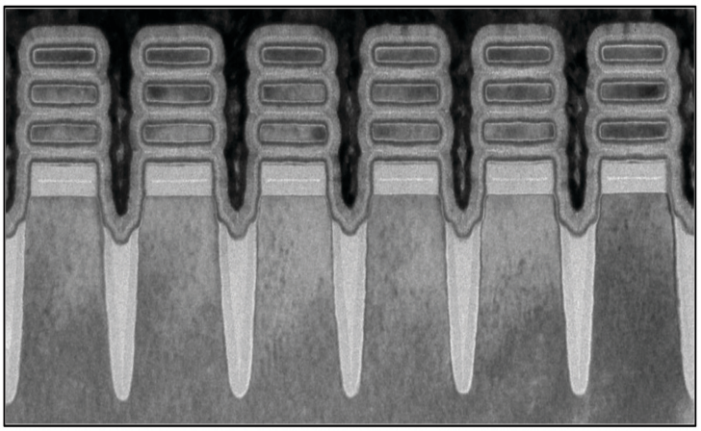
TELLA PRIYANKA
Roll No. 17711A0299, IV EEE

IBM at the forefront of semiconductor innovation

This latest breakthrough builds on decades of IBM leadership in semiconductor innovation. The company's semiconductor development efforts are based at its research lab located at the Albany Nanotech Complex in Albany, NY, where IBM scientists work in close collaboration with public and private sector partners to push the boundaries of logic scaling and semiconductor capabilities.

This collaborative approach to innovation makes IBM Research Albany a world-leading ecosystem for semiconductor research and creates a strong innovation pipeline, helping to address manufacturing demands and accelerate the growth of the global chip industry.

IBM's legacy of semiconductor breakthroughs also includes the first implementation of 7 nm and 5 nm process technologies, single cell DRAM, the Dennard Scaling Laws, chemically amplified photoresists, copper interconnect wiring, Silicon on Insulator technology, multi core microprocessors, High-k gate dielectrics, embedded DRAM, and 3D chip stacking. IBM's first commercialized offering including IBM Research 7 nm advancements will debut later this year in IBM POWER10-based IBM Power Systems.



SHAIK RAYAN RIMSHA,
Roll No. 17711A0292, IV EEE

50 Billion Transistors on a fingernail-sized chip

Increasing the number of transistors per chip can make them smaller, faster, more reliable, and more efficient. The 2 nm design demonstrates the advanced scaling of semiconductors using IBM's nanosheet technology. Its architecture is an industry first. Developed less than four years after IBM announced its milestone 5 nm design, this latest breakthrough will allow the 2 nm chip to fit up to 50 billion transistors on a chip the size of a fingernail.

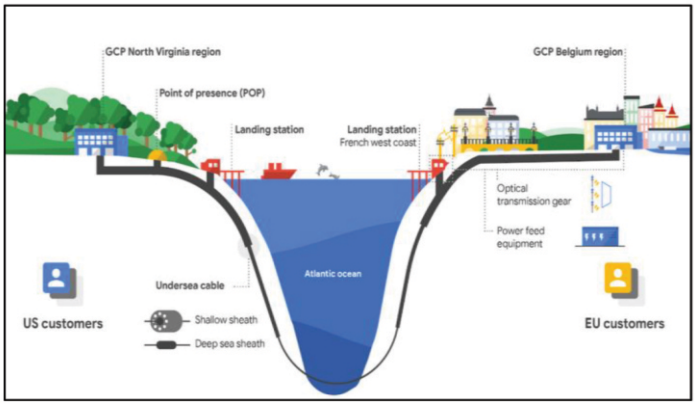
More transistors on a chip also means processor designers have more options to infuse core-level innovations to improve capabilities for leading edge workloads like AI and cloud computing, as well as new pathways for hardware-enforced security and encryption. IBM is already implementing other innovative core-level enhancements in the latest generations of IBM hardware, like IBM POWER10 and IBM z15.

ARAVA JESSICA
Roll No. 18711A0205, III EEE

March 2021-Google announces plans to build a new undersea cable to connect the US, UK, and Spain, which will be powered by renewable

"Google is dedicated to meeting the exploding demand for cloud services and online content that continues unabated," said Mark Sokol, senior director of Infrastructure, Google Cloud. "With record-breaking capacity and transmission speeds, Dunant will help users access content wherever they may be and supplement one of the busiest routes on the internet to support the growth of Google Cloud. Dunant is a remarkable achievement that would not have been possible without the dedication of both SubCom and Google's employees, partners, and suppliers, who overcame multiple challenges this year to make this system a reality."

With Dunant now being operational, the next Google cable to go live will be the Grace Hopper cable between New York and Europe, with landing sites in Bilbao, Spain and Bude, UK. Google first announced this new cable, which it is also building in partnership with SubCom



, last July. It's expected to go online in 2022 and will feature a total of 16 fibre pairs. In addition, Google is also building the Equiano cable from South Africa to Portugal. This cable is supposed to go online later this year.

In addition to its privately owned cables, Google is also a partner in a number of consortiums that band together to build cable systems.

KANTEPALLI AMULYA
Roll No. 18711A0225, III EEE

April 2021 -Apple announces plans to invest $430 billion in the US over the next five years, including significant investments in renewable energy

The accelerated commitment will fund a new North Carolina campus and job-creating investments in innovative fields like silicon engineering and 5G technology.

CUPERTINO, CALIFORNIA, Apple today announced an acceleration of its US investments, with plans to make new contributions of more than $430 billion and add 20,000 new jobs across the country over the next I've years. Over the past three years, Apple's contributions in the US have significantly outpaced the company's original five-year goal of $350 billion set in 2018. Apple is now raising its level of commitment by 20 percent over the next five years, supporting American innovation and driving economic benefits in every state.

This includes tens of billions of dollars for next-generation silicon development and 5G innovation across nine US states. "At this moment of recovery and rebuilding, Apple is doubling down on our commitment to US innovation and manufacturing with a generational investment reaching communities across all 50 states," said Tim Cook, Apple's CEO. "We're creating jobs in cutting-edge fields — from 5G to silicon engineering to artificial intelligence — investing in the next generation of innovative new businesses, and in all our work, building toward a greener and more equitable future."

Today, Apple supports more than 2.7 million jobs across the country through direct employment, spending with US suppliers and manufacturers, and developer jobs in the thriving iOS app economy. Apple is the largest taxpayer in the US and has paid almost $45 billion in domestic corporate income taxes over the past five years alone.

Apple's $430 billion in contributions to the US economy include direct spend with American suppliers, data centre investments, capital expenditures in the US, and other domestic spend — including dozens of Apples TV+ productions across 20 states, creating thousands of jobs and supporting the creative industry.

AKURATHI BHARGAVI
Roll No. 18711A0248, III EEE

Establishing a New North Carolina Campus

As part of its investments and expansion, Apple plans to invest over $1 billion in North Carolina and will begin construction on a new campus and engineering hub in the Research Triangle area. The investment will create at least 3,000 new jobs in machine learning, artificial intelligence, software engineering, and other cutting-edge fields.

Apple will also establish a $100 million fund to support schools and community initiatives in the greater Raleigh-Durham area and across the state, and will be contributing over $110 million in infrastructure spending to the 80 North Carolina counties with the greatest need — funds that will go toward broadband,

roads and bridges, and public schools. When up and running, Apple's investments are expected to generate over $1.5 billion in economic benefits annually for North Carolina.

TELAPALLI SAI SUKRUTHA
Roll No. 19711A0249, II EEE

May 2021-Toyota unveils a new electric vehicle battery design that uses solid-state technology, which could increase the driving range and reduce the charging time of electric cars.

TOKYO -- A trip of 500 km on one charge. A recharge from zero to full in 10 minutes. All with minimal safety concerns. The solid-state battery being introduced by Toyota promises to be a game changer not just for electric vehicles but for an entire industry.

The technology is a potential cure-all for the drawbacks facing electric vehicles that run on conventional lithium-ion batteries, including the relatively short distance travelled on a single charge as well as charging times. Toyota plans to be the first company to sell an electric vehicle equipped with a solid-state battery in the early 2020s. The world's largest automaker will unveil a prototype next year.

The electric vehicles being developed by Toyota will have a range more than twice the distance of a vehicle running on a conventional lithium-ion battery under the same conditions. All accomplished without sacrificing interior space in even the most compact vehicle.

Solid-state batteries are expected to become a viable alternative to lithium-ion batteries that use aqueous electrolyte solutions. The innovation would lower the risk of fires, and multiply energy density, which measures the energy a battery can deliver compared to its weight.

It would take roughly 10 minutes to charge an electric vehicle equipped with a solid-state battery, cutting the recharging time by two-thirds. The battery can extend the driving distance of a compact electric vehicle while maintaining legroom.

Toyota stands at the top of the global heap with over 1,000 patents involving solid-state batteries. Nissan Motor plans to develop its own solid-state battery which will power a non-simulation vehicle by 2028.

The shift toward the new battery technology will also have an effect on companies further down the supply chain.Japanese auto materials makers are rushing to set up the necessary infrastructure to supply automakers. Mitsui Mining and Smelting, commonly known as Mitsui Kinzoku, will start up a pilot facility that will make solid electrolytes for the batteries.

The production site, located at a research and development centre in Saitama Prefecture, will be able to produce dozens of tons of solid electrolyte annually staring next year, enough to fulfil orders for prototypes.

Oil company Idemitsu Kosan is installing solid electrolyte production equipment at its Chiba Prefecture site with the aim of beginning operation next year. Manufacturing solid electrolytes requires solidifying sulphides, which is a specialty of the metal and chemical industry. Sumitomo Chemical is developing material as well.

Japanese manufacturers like Sony and Panasonic have been pioneers in commercializing battery cells for vehicles. But since the late 2000s, Chinese rivals have emerged to prominence. Contemporary Amperex Technology Co. Limited, also known as CATL, is now the world's largest supplier of lithium-ion batteries. Japan's Asahi Kasei, once the global leader in battery separator material, gave up the crown last year to Shanghai Energy.

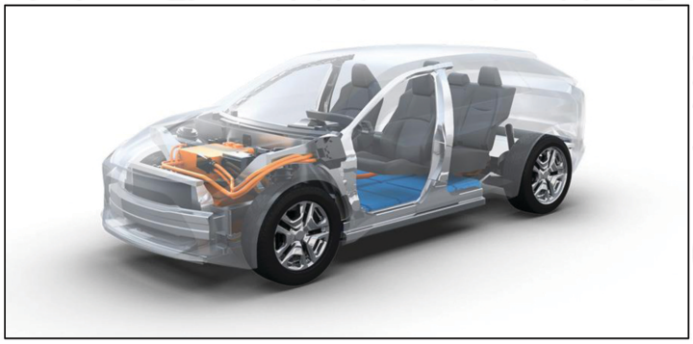
Electric vehicles are anticipated to become commonplace amid the global shift away from carbon. The Japanese government has been encouraging the domestic development of solid-state batteries, under the outlook that most of the technology relating to automotive performance will depend on China if the status quo holds.

The government is putting together a fund of about 2 trillion yen ($19.2 billion) that will support decarbonization technology.

Policymakers will consider using those funds to provide subsidies of hundreds of billions of yen that will fund the development of the new batteries.

The goal is to support the development of a mass-production infrastructure within Japan. Because solid-state batteries use lithium, an element with limited global reserves, the government will assist in procuring the material.The rest of the world is following suit. Germany's Volkswagen plans to have production running for solid-state batteries as soon as 2025 via a joint-venture with a U.S. startup.

Chinese tech group Qing Tao (Kunshan) Energy Development will spend over 1 billion yuan ($153 million) into R&D of solid-state batteries, among other areas. The investment will last for three years.



YARABOLU NIKITHA
Roll No. 19711A0259, II EEE

June 2021 - Amazon announces plans to purchase 100,000 electric delivery vehicles from electric vehicle start-up Rivian, as part of its goal to become carbon neutral by 2040.

A sprawling industrial complex in Michigan doesn't look anything like it did decades ago when American workers assembled automated teller

machines in the building. Today, sun-drenched white walls surround a design studio. Light bounces off gleaming floors to highlight scale model vehicles that are nearing final design.The vehicles are the next generation of Amazon delivery vans—electric-powered vehicles that will hit the roads beginning in 2021.Amazon ordered 100,000 electric delivery vehicles—the largest-ever order of electric delivery vehicles—from Rivian, a producer of emissions-free electric vehicles with a vehicle development centre in Plymouth, just outside Detroit.

The order is part of The Climate Pledge, Amazon's commitment to meet the Paris Agreement 10 years early. The pledge also calls on signatories to become net zero carbon across their businesses by 2040, a decade ahead of the Paris Accord's goal of 2050.

DOMA TEJASWINI
Roll No.20715A0215, II EEE

A full-sized clay model of Amazon's electric delivery vehicle at Rivian headquarters in Plymouth, Michigan.

"We're trying to build the most sustainable transportation fleet in the world," said Ross Rachey, director of Amazon's global fleet and products. "It also needs to be the most functional, the highest performing, the safest."

Amazon's transportation team spent 18 months evaluating a variety of electric vehicle options to reduce its carbon footprint. To move quickly, Rachey's team realised the best way forward was to chart their own path and create a new, custom electric vehicle to meet Amazon's needs now and in the future.

The vehicles will reduce carbon emissions, raise the bar for driver safety, and optimise technology and design elements to create a best-in-class driver experience.

Rivian's showroom features three scale models of Amazon's electric delivery vehicles.

Manufactured at Rivian's plant in Normal, Illinois, they'll come in three size variants and support multiple battery sizes so they can be optimised for specific delivery routes."We are focused on driving efficiency into every aspect of the vehicle design—everything from cabin heating to driver ergonomics to drivetrain design has been optimised for time and energy," said R.J. Scaringe, CEO of Rivian. "And then the echo effect of this, of causing other logistics players in this space to also look at how they drive up efficiency within their fleet, will have a very large impact."Dave Clark, Amazon's senior vice president of worldwide operations, looks forward to the vehicle program's ripple effect.

Devon Cooper was invited to check out the new vehicles and share feedback with Rivian engineers. He's a Detroit-area delivery associate who works for an Amazon Delivery Service Partner to deliver packages to Amazon customers. "Everything that I suggested was already on there," Cooper said. Amazon's new electric delivery vehicles will begin delivering packages to customers in 2021. The company plans to have 10,000 of the vehicles on the road as early as 2022 and all 100,000 vehicles on the road by 2030—saving millions of metric tons of carbon per year by 2030.

ARDALAMITTA VANDANA
17711A0205 IV EEE