Leveraging Blockchain in Energy Transition and Decarbonization

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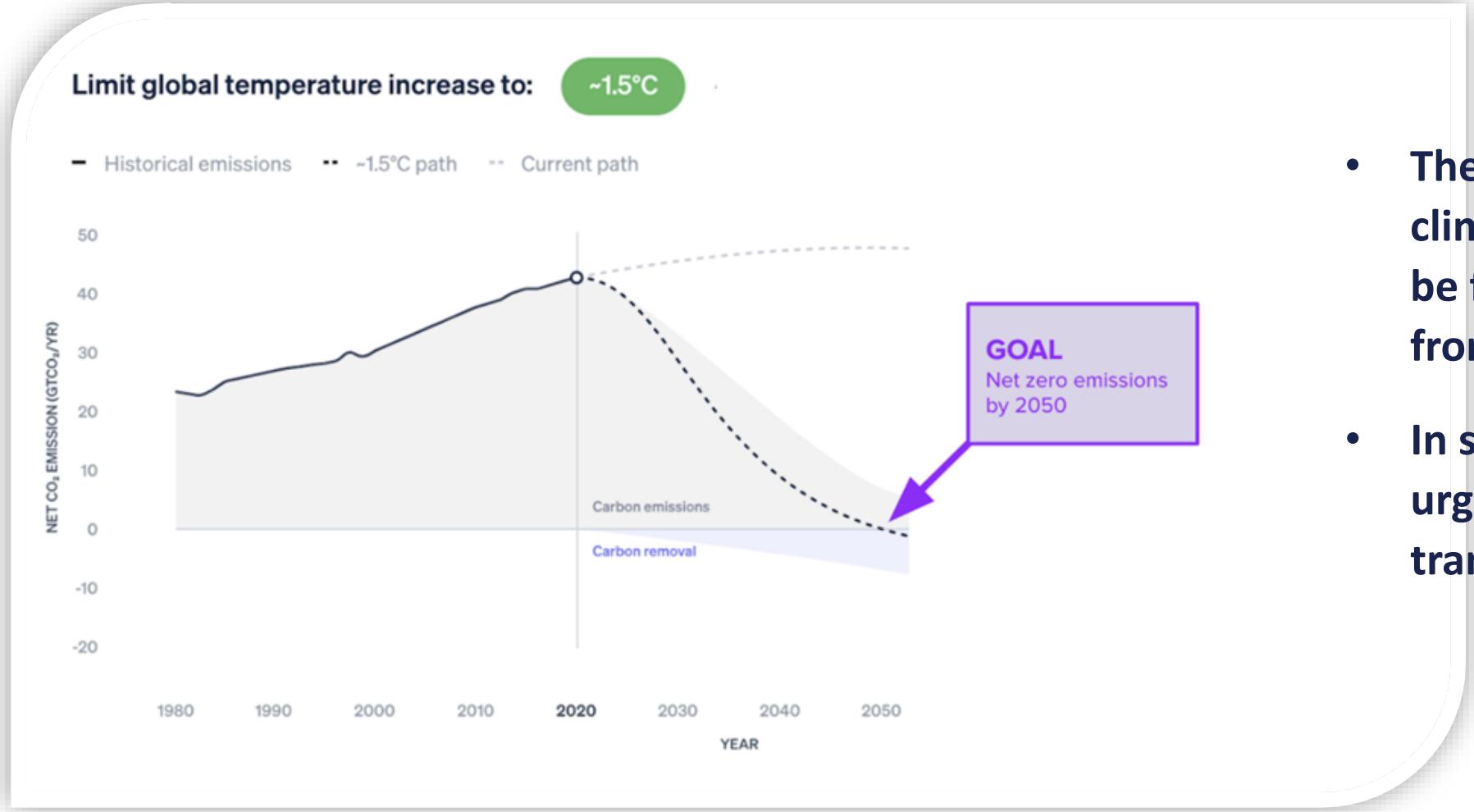
COP 28

- ✓ Fast-track energy transition
- ✓ Tripling renewable
- ✓ Doubling energy efficiency
- ✓ Strategic mobilization of finance

COP28 UAE - United Nations Climate Change Conference

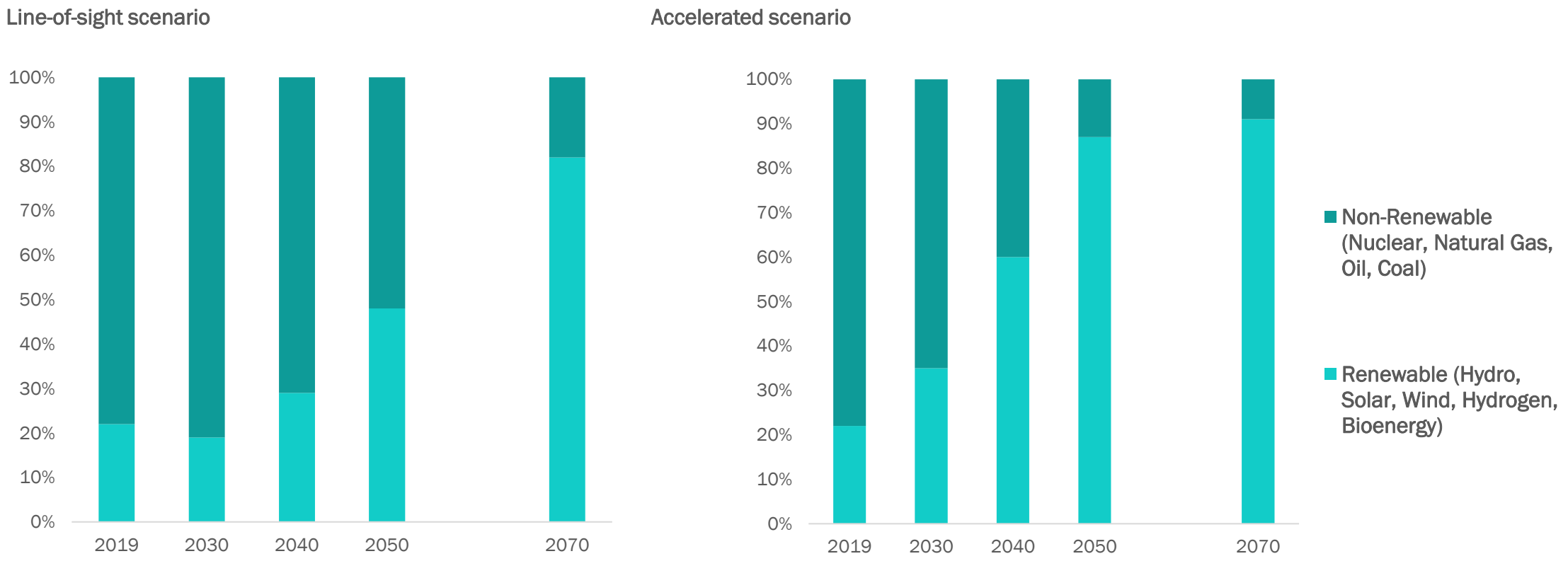
LIMIT GLOBAL TEMP RISE TO 1.5 DEGREES



- **The battle against climate change has to be fought on many fronts**
- **In short, there is an urgent need to ACT-transition space**

Source: International Energy Agency, McKinsey India Decarbonization Model
https://www.mckinsey.com/capabilities/sustainability/our-insights/decarbonising-india-charting-a-pathway-for-sustainable-growth

INDIA'S OUTLOOK



Source: International Energy Agency, McKinsey India Decarbonization Model
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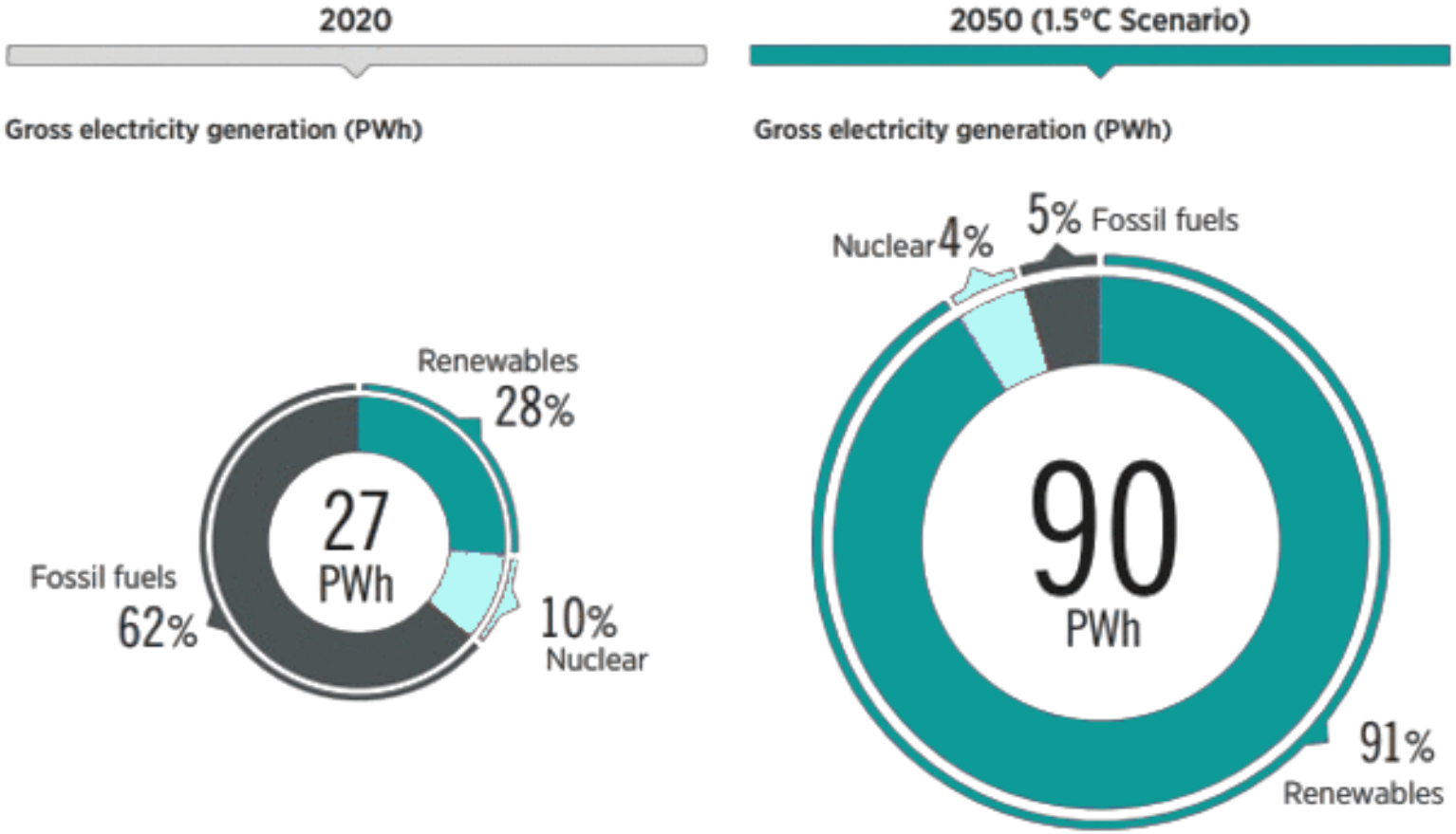
Global Outlook

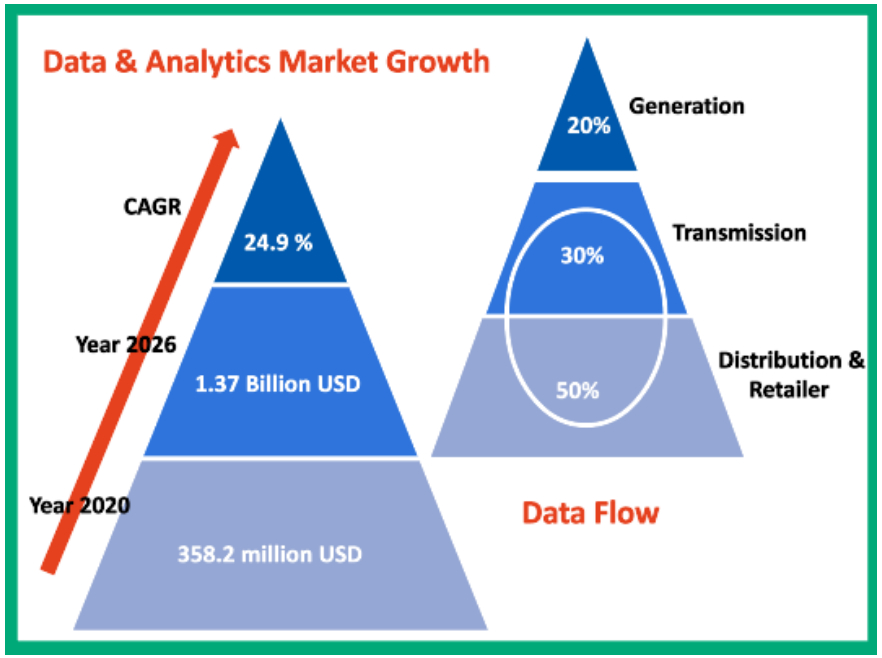


Power generation needs to more than triple by 2050 in the 1.5 ° scenario of the Paris Agreement, mainly driven by renewables, which are projected to drastically replace fossil fuels as the primary energy source

Source: IRENA World Energy Transitions Outlook 2023
https://www.irena.org/Publications/2023/Jun/World-Energy-Transitions-Outlook-2023

ENHANCED GRID AGILITY

1	Digitalization System, Network, Process-people-plant –Market Data	**Digital Transformation, enabling AMI , PMU, IOT, Sensors, SCADA** • Generation of huge Data :- Consolidation, Data governance • Data market place - Knowledge base • Smart Meter analytics – system , network, customer • Smart Reporting and Display , Behind the meter analysis
2	Decarbonization-Sustainability Goals DER + EV	**Net ZERO carbon Target - Renewables and E- Vehicles Analytics** • Forecasting - Solar- Wind Power Generation Prediction • Data driven model to frequency-inertia • Storage Optimization , Prosumer analytics • Better revenue models, EV Analytics
3	Deregulation-Operational Flexibility, Newer Trading opportunities	**Performance Enhancement** • Generation scheduling, dispatch, system balancing • Asset Utilization & Efficiency Management framework • Anomaly detection for failure patterns, Re-use potential



Utility Experience -

- ❑ *Need to leverage the potential of Data*
- ❑ *Difficulty to Handle market, DER DATA-volatility and uncertainty*
- ❑ *Increased dependency on data driven analytics*

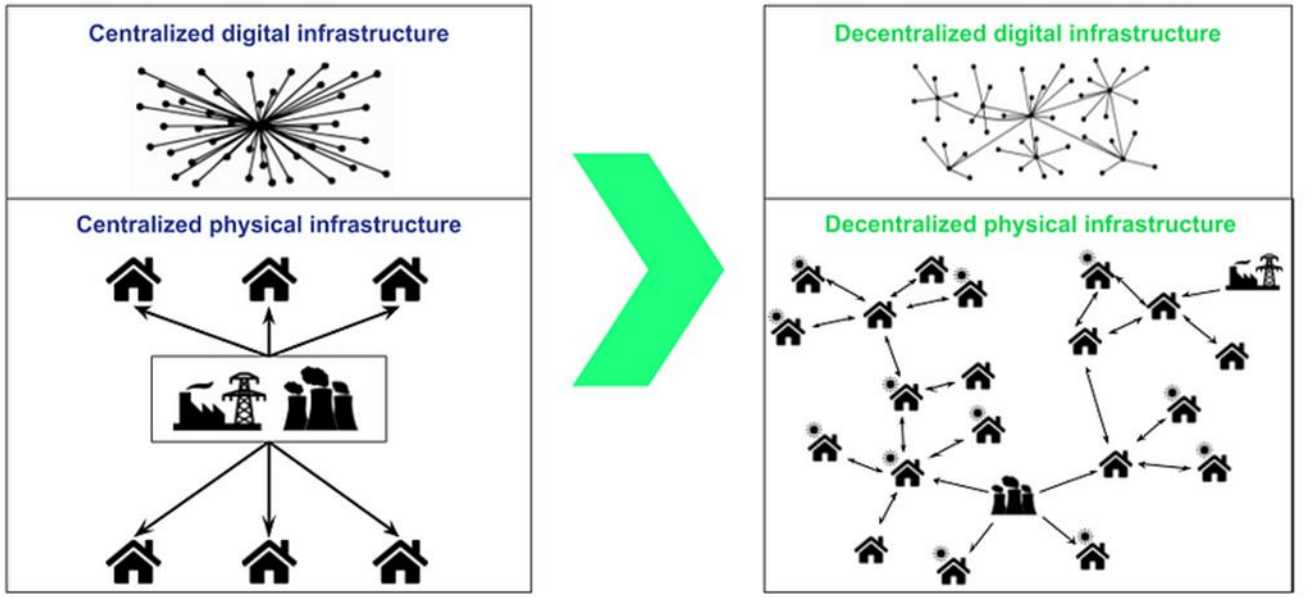
Tasks-Strategy of bidding, trading, risk trade-off, long- term , short- term, spot market participation, market clearing, system operations, downstream control actions, DER and prosumer participation etc

Utility ecosystem:-
Policy Makers, Investors, Market Operators, Generation utility, Sup pliers, Transmission Utility, Power Traders, Open access Industries etc.

To Ascertain the volatility of electricity market by developing accurate price forecasting model

https://www.mckinsey.com/industries/oil-and-gas/our-insights/global-energy-perspective-2021

UTILITY INDUSTRY TRANSFORMATION

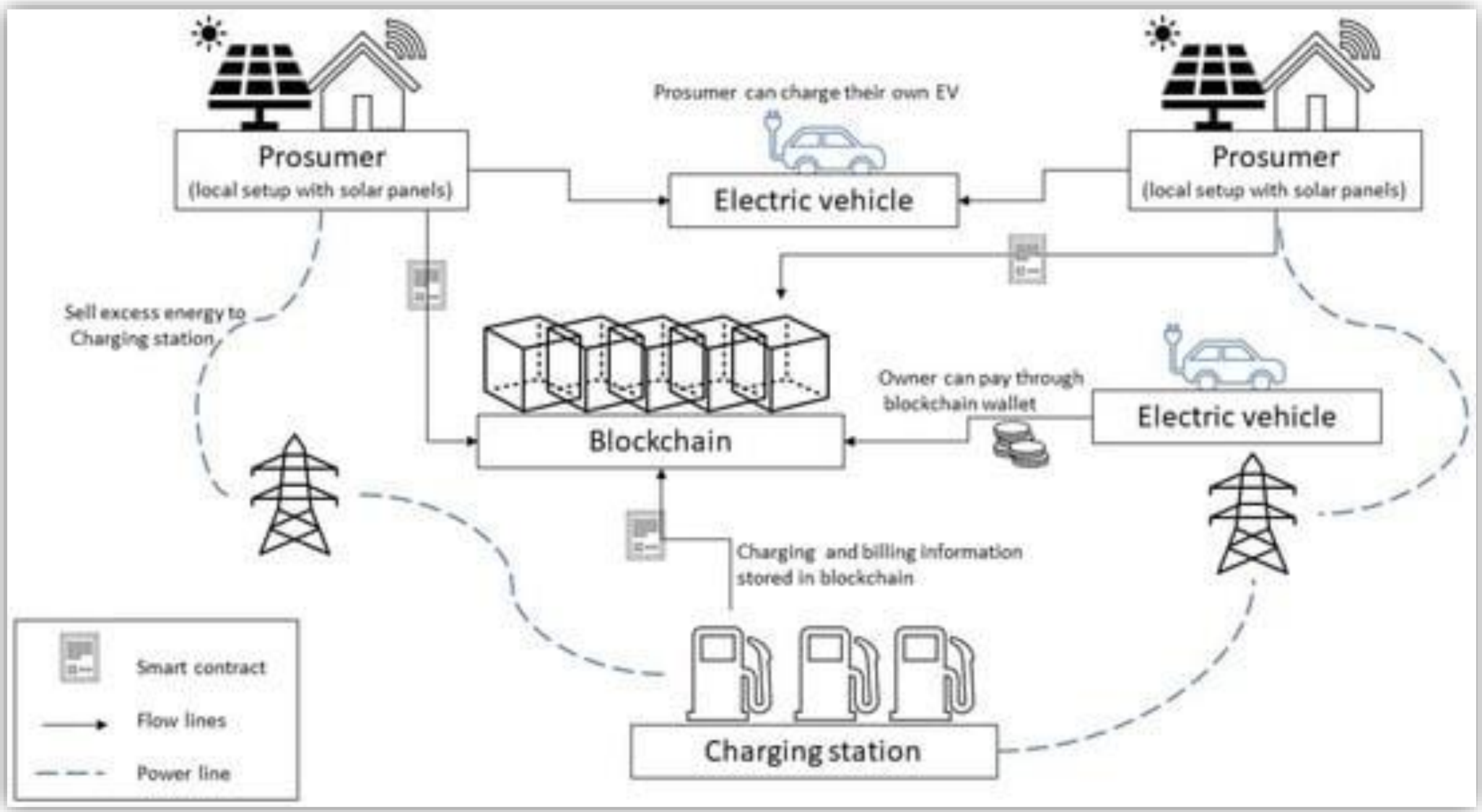


… KPIs , customers demand better, green and reliable performance outcomes from their electricity providers

Reliability | Safety | Security | Resilience | Flexibility | Clean Energy | Cost & Affordability

Acknowledgement: McKinsey
Modernizing the investment approach for electric grids, November 11, 2020

UTILITY ECOSYSTEM AND OPPORTUNITIES



Digital interventions- Data Analytics and AI tools, AR , VR , Blockchain , Digital Twin

- **Predictive models-** Prediction of load, generation
- **Diagnostic model-** Asset failure analytics
- **Prescriptive models-** Health management
- Fault finding and restoration of system
- **Operational Optimization**
- **Scenario Modelling**
- G-V-G interactions- blockchain
- Peer to peer trading –blockchain based smart contracts

https://ecochain.com/knowledge/impact-categories-lca/

LEVERAGING BLOCKCHAIN- KEY LEVERS + POTENTIAL = OUTCOMES

Key Levers

- Energy Transition
- Decarbonization
- Regulatory incentivisation
- Digitalization and Distributed value chain
- Open Data and Transparency
- Inclusive role of customer
- Sustainability driven business transformation
- Technology adoptability
- Cost optimization
- Trading Risk assessment & Hedging

Potential of Blockchain

- Streamline Process
- Streamline Data sharing
- Smart contracts
- Smart transactions
- Transparent auctions
- Multi-stakeholder integration
- Secure settlement

Business Use Case

- Billing and payment
- DER Registry and accountability in grid balancing
- Wholesale trading of power
- Renewable Energy Certificates issuance & Trading
- Asset maintenance management – field force, inventory, billing etc
- Demand Response management
- P2P trading
- EV charging , swapping market

Outcomes

- New Business/Revenue Models
- Enhanced Operational KPIs
- Expense Ratio Management
- Increased procedural simplicity
- Faster processing
- Improved Customer experience
- Full capacity Utilization
- Transparent and secure Auctions, Bids
- Ecosystem- internal + External

SUSTAINABILITY ASPECTS- UTILITY INDUSTRY

UPSTREAM

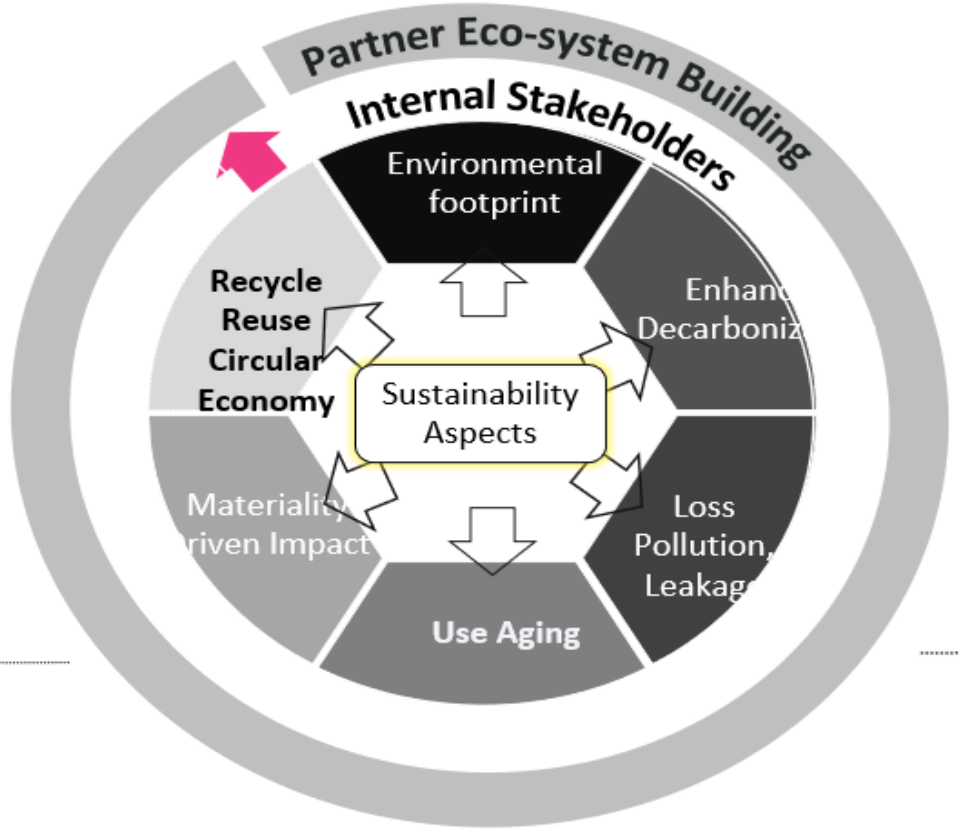
Impacts from materials and inbound supply chain

Significant GWP* impact of materials & source, transport – Construction, Substation, Assets across network

- Assets Choices (type, source, transport)
- Supply-chain – need for embedding circularity principles
- Visibility into upstream suppliers, activities & transportation from ESG perspective

Downstream

- *Impacts from operations ,*
- *Distribution Utilities ,Customers*



CORE – Capital + Operational

Impacts from operations

High GWP* impact of Network, Sub station, Assets & processes

Power Transfer across Network

- Energy inefficiencies, losses
- Type of energy procured

Power Transfer **through Decarbonization**

energy procured from lateral countries- Inter-connectors, HVDC etc , Off shore wind

Product Safety & Hazard

- Human Toxicity impacts in products
- Leakage of SF6, oil

Scope 3- Indirect

- *Impacts from supply-chain*
- *Impact from construction*
- *Impact of maintenance supply-chain*
- *Business Travel, Employee commute ,*
- *Inflow of goods, services*
- *Downstream sold electricity to DNO , customer usage*
- *Waste generated in value chain*
- *Material impact of new HVDC, Interconnectors*

Scope 2- Indirect

- *Impacts from energy consumptions*
- *Line losses*
- *Power Purchase , Interconnectors*

Scope 1- Direct

- *Impacts from operation*
- *Network and Assets Operations-Live*
- *Power Flow*
- *Line losses*
- *SF6 /Oil leakage*
- *Renewable Power injection*
- *Fleet vehicle use*
- *Maintenance operations*

Scope 1, Scope2, Scope 3 Emission Assessment + Management

Circular Economy Recycle-Reusability

Minimize Leakage , Waste, Loss, Pollution

Environment, Community, Governance, Bio diversity

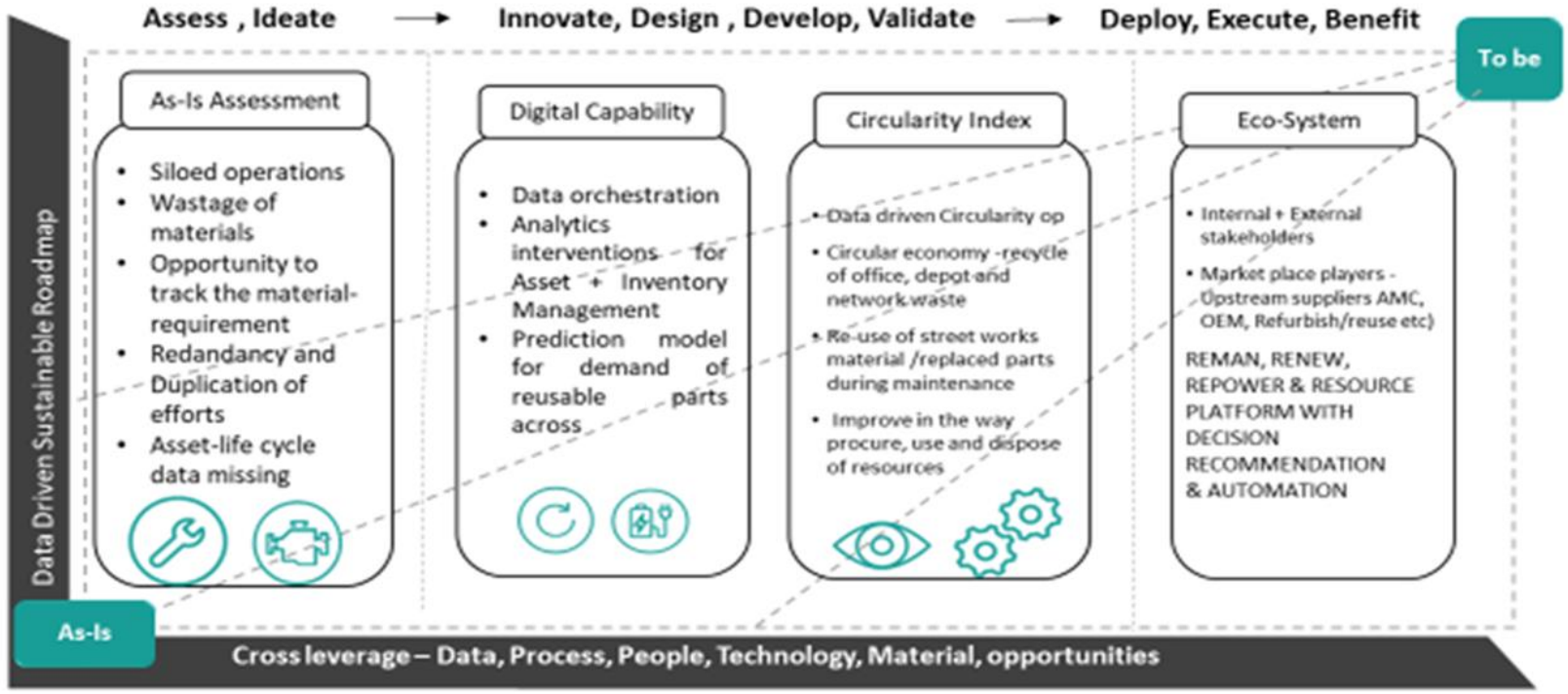
Network, assets, process, people, Technology, Data

CIRCULAR ECONOMY AND BLOCKCHAIN

Circular Utility

Circular Electric Utilities

- Aligning on a standardized definition and methodology for evaluating circularity performance
- Developing a market and supply chain strategy to address barriers related to scale, demand, logistics, Ensure sustainable consumption from the electric utility supply chain of critical minerals needed for the low-carbon economy transition



OUTCOMES/VALUE- Traceability & Circularity of materials

- Secondary marketplace for all , Open data platform , Blockchain–e.g Offgem
- CE model for maintenance activity ,C Ecosystem for Newer expansions
- Repository of reusable parts (Roster – Common Data), Attempt to Zero Waste to landfill
- Become an Industry benchmark in Circularity and Sustainability target on ZERO Waste

INDIA'S INITIATIVE:-NET ZERO WARRIOR

- **Joint Initiative of IEEE and Transition Venture Capital (TVC) –MoU singed on 13th July 23, Bangalore.**

- The primary objective of this initiative is to enable numerous startups, originating from both the academic community and young professionals, to develop advanced technological solutions in sectors undergoing transition, to addressing the dual challenge of environmental preservation and economic growth, aligning with India's energy security requirements.

- "Net Zero Warriors" aims to create a roadmap for four important groups: Engineering Students, Start-ups, MSME Industry, and the IEEE Standards Association. The initiative aims to promote awareness of deep-tech opportunities and encourages young engineers and entrepreneurs to tackle innovation challenges with commercialization goals.

- It offers support through capital funding, sector expertise, and mentorship to facilitate inventive solutions and determined entrepreneurs to expand into deep technologies such as AI, Data Analytics, Robotics, Blockchain, Computational Intelligence, and Cognitive Computing.

Sections Congress Climate Change Pavilion

Increase your knowledge of climate change

Gain an understanding of what IEEE is doing in response

Personally commit by making a pledge

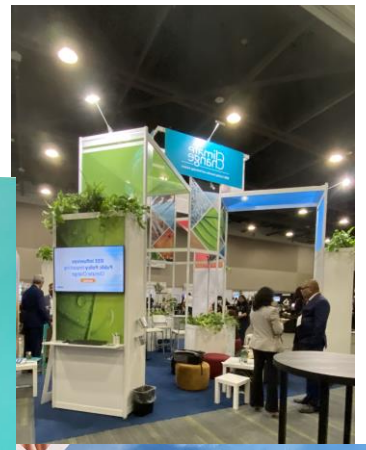
- See what IEEE units are doing to impact climate change;
- Join the conversation with IEEE volunteers who are leading the charge
- Access interactive touch screens to learn more about your climate locally
- Learn more about the climate change website and how to engage with the New Newsletter!

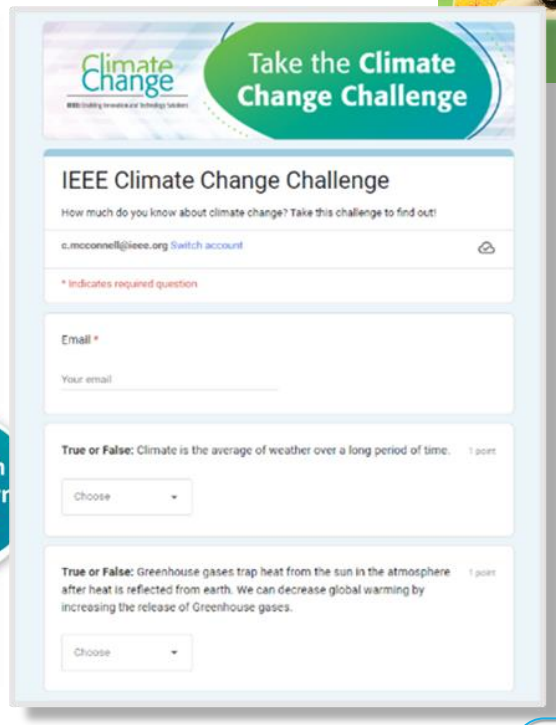
Climate Change Pavilion at Sections Congress on 12-13 August in Ottawa!

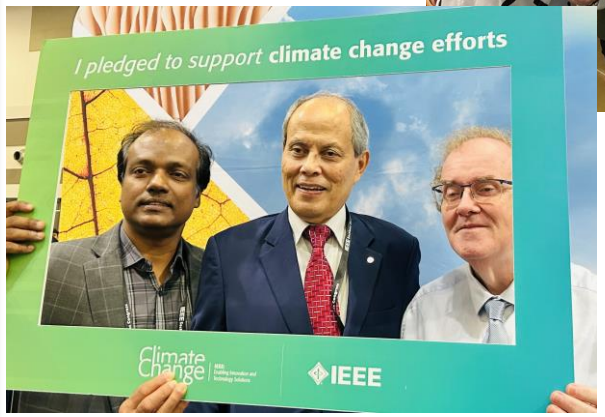
- **IEEE Climate Change Website –https://climate-change.ieee.org**

Sections Congress Climate Change Pavilion

- **Almost 1,200 attendees at Sections Congress**
- **Climate Change Pavilion held center space at the exhibit hall**
- **Positive feedback on the pavilion presence**







- **IEEE Climate Change Website –https://climate-change.ieee.org**

COP 28 – IEEE 's response to Climate Change

THANK YOU!

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TECHNO-ECONOMICAL OPPORTUNITIES

Complex and diverse billing system	Distributed immutable ledger (Reliable, secure and auditable
Potential Energy transition - DER accountability	Blockchain based Registration – One place data of multiple assets with better data management Distributed Ledger-based register – System operator get a clear picture of generation, storage, load requirement, better balancing Flexible trading platforms & local market
Wholesale Electricity Trading – Complex procedures , multilayered decision making, reconciliation with multi-stakeholders Renewable Energy Certificates Issuance & Trading	Blockchain – integrate entire Trade-cycle Multi-stakeholder collaboration of operational data Automatic Post trading reconciliation
Demand Response to achieve flexibility in consumption to support system-balancing – Complex, defer with data security and privacy of participantsin DR event	Blockchain based DR– Energy data stored in digital identity locally. Real time energy data- stored as blocks as transaction replicated at nodes Smart contracts – ensure grid balance

NEW REVENUE STREAMS

Asset Management	Blockchain based Prescriptive and condition based maintenance - Efficient Monitoring with real time data from IoT Smart contracts tigger the maintenance (anomaly) Facilitate secure communication and data exchange – workforce, inventory,
P2P trading	Small customers can sell power to another customer with no intervention of aggregator etc
EV Charging	Blockchain based market place - Gain commercial benefit with availing maximum capacity utilization EV owner – raise a request –receive bids from listed stations Decentralised & transparent auction Smart contract –secure P2P energy payments
EV battery Swapping	Blockchain based Battery Swapping market – EV owners, OEMS/ Swapping centres Avail the secure auction to select the best bid Smart contract- automates smart management, billing and settlement process