



Power and Renewable Energy: Industrialist's Perspective

16th December 2022



EY

Building a better
working world

What we will cover ?

1

Background

2

Key Challenges
and Risks

3

Mitigating Options

4

XXXXXXXX

5

Way Forward

Climate change is a defining challenge for all

Climate impacts and responses will transform established sectors and provisioning systems over coming decades.

- ▶ All businesses in all sectors will be affected by this transition, and all will be expected to contribute to the solutions.
- ▶ Every effective strategy to limit climate change requires a transition to net zero emissions.
- ▶ Making and implementing a credible & a sustainable decarbonisation strategy is challenging for businesses, particularly in emissions-intensive sectors.



Observed global warming till date is assessed to be 1.09 degrees above pre-industrial levels.



Estimated date of crossing 1.5 degree increase: early 2030's, 10 years earlier than previous estimate.



Global commitment towards transition is significant yet ambitious without financing commitments

800

Companies have SBTi aligned NZE targets

88%

Global GHG emissions covered (with country targets in policy document, proposed legislation and in law).

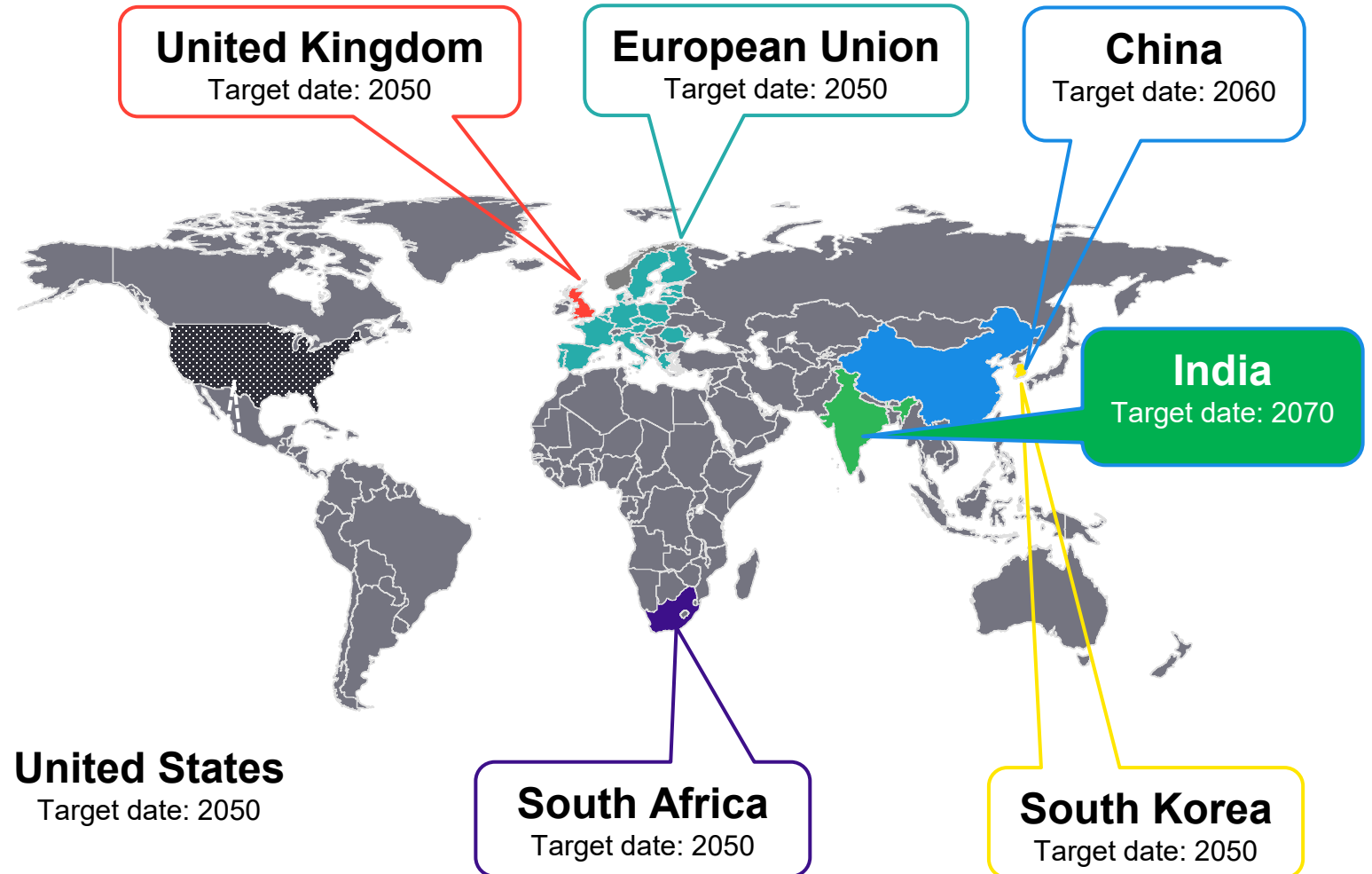
140

Countries have set Net Zero targets

Net zero targets currently cover 24.6 Giga tCO₂ out of global emissions of ~40 Giga tCO₂. (Fossil + Land use). For 1.5 degree target, the remaining carbon budget is **400 Giga tCO₂**.

At current emissions levels, carbon budget will be exhausted in **10 years**.

European Companies are also looking at setting Value Chain (Scope 3) Emissions reduction targets

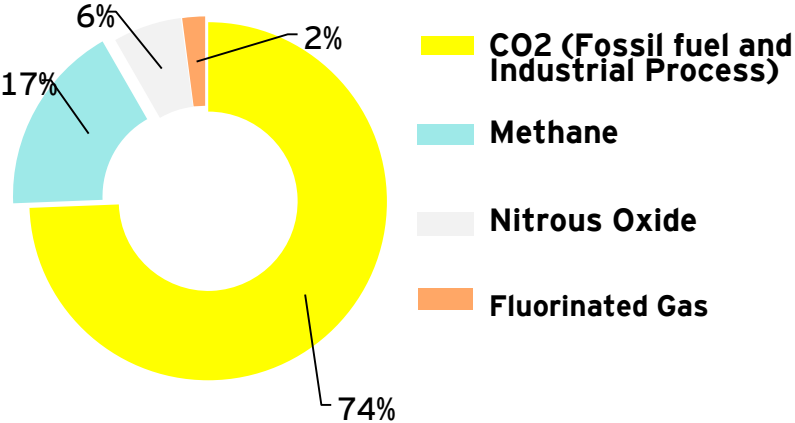


Net Zero Timelines announced by Governments

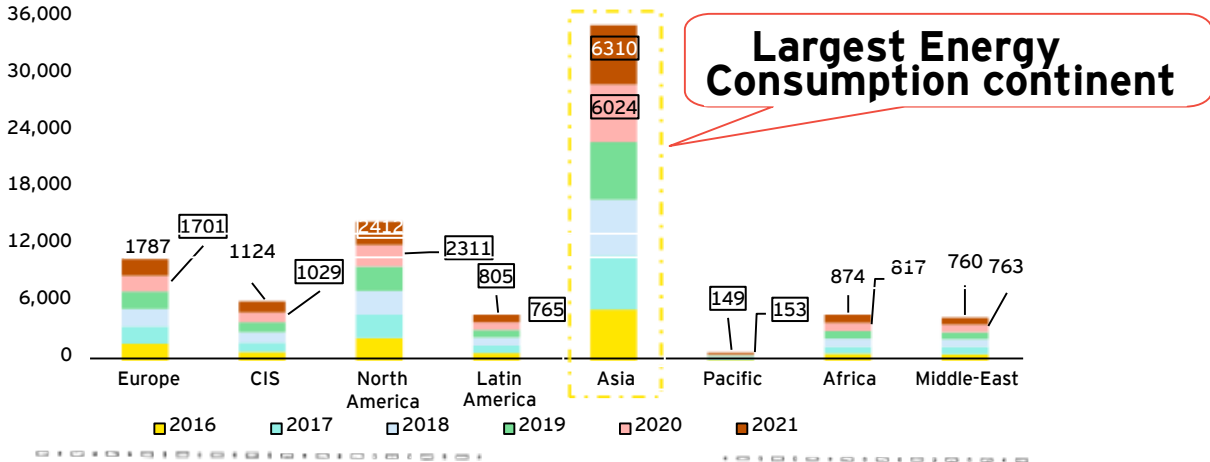
Asia is the largest energy consumption continent....

Global Energy Consumption and CO₂ Emission Scenario

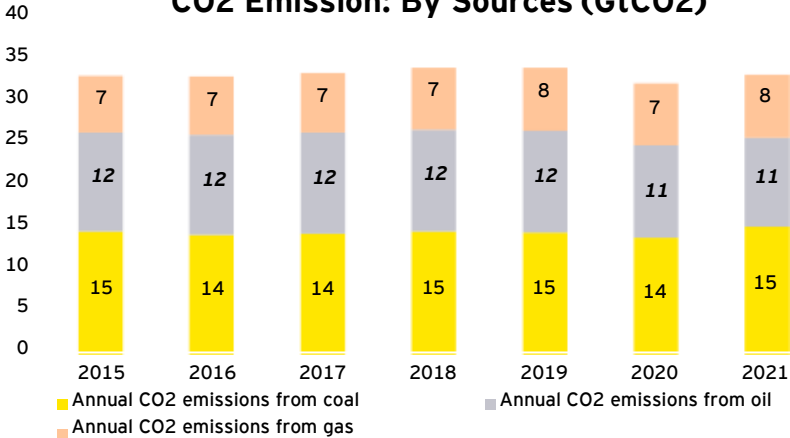
GHG Contribution (%)



Global Energy Consumption (in Mtoe)



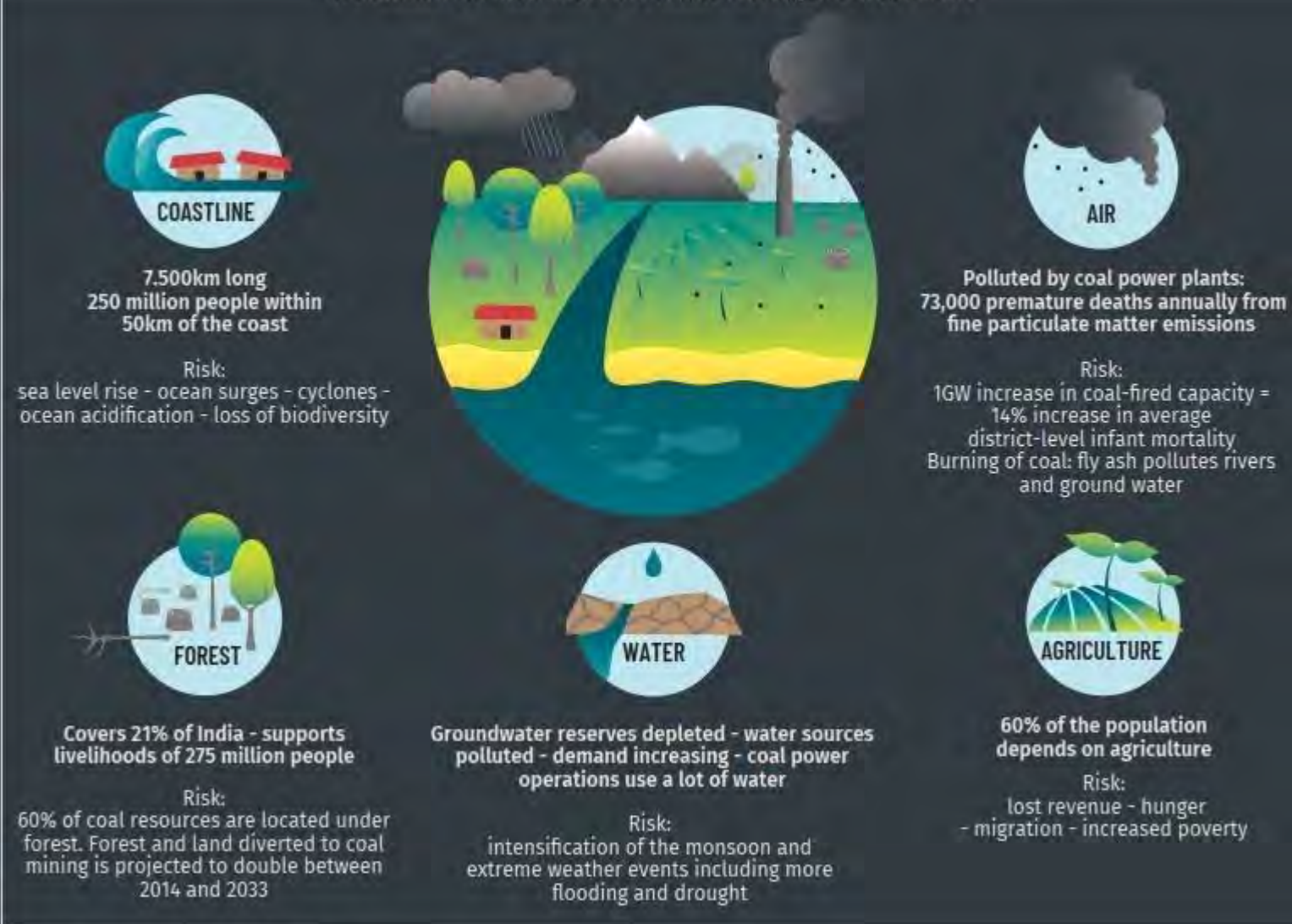
CO₂ Emission: By Sources (GtCO₂)



- ❖ CO₂ is the largest contributor to Green House Gas emissions ~ 74%.
- ❖ Globally, energy consumption has increased - post covid era (2020) leading to continuous increase in CO₂ emission.
- ❖ Asia, one of the largest continents is the frontrunner in energy consumption.
- ❖ Fossil fuels mainly Coal, Oil & Gas are the major contributor to CO₂ emission and has been rising since last 5 years.

Climate Change and Impacts - India

VULNERABILITY OF INDIA TO CLIMATE CHANGE AND COAL RELATED IMPACTS



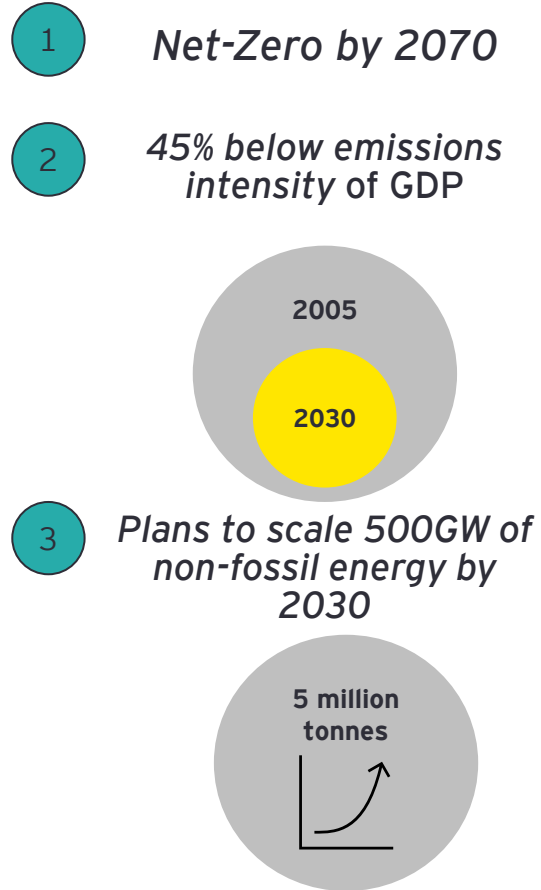
Implications on future intergovernmental negotiations on Climate Change

- ▶ Human-induced climate change is already affecting many weather and climate extremes in every region across the globe.
- ▶ India: There is a high degree of confidence on increasing trends for:
 1. Extreme heat events
 2. Heavy precipitation
 3. Coastal floods and erosion
 4. Relative sea level rise

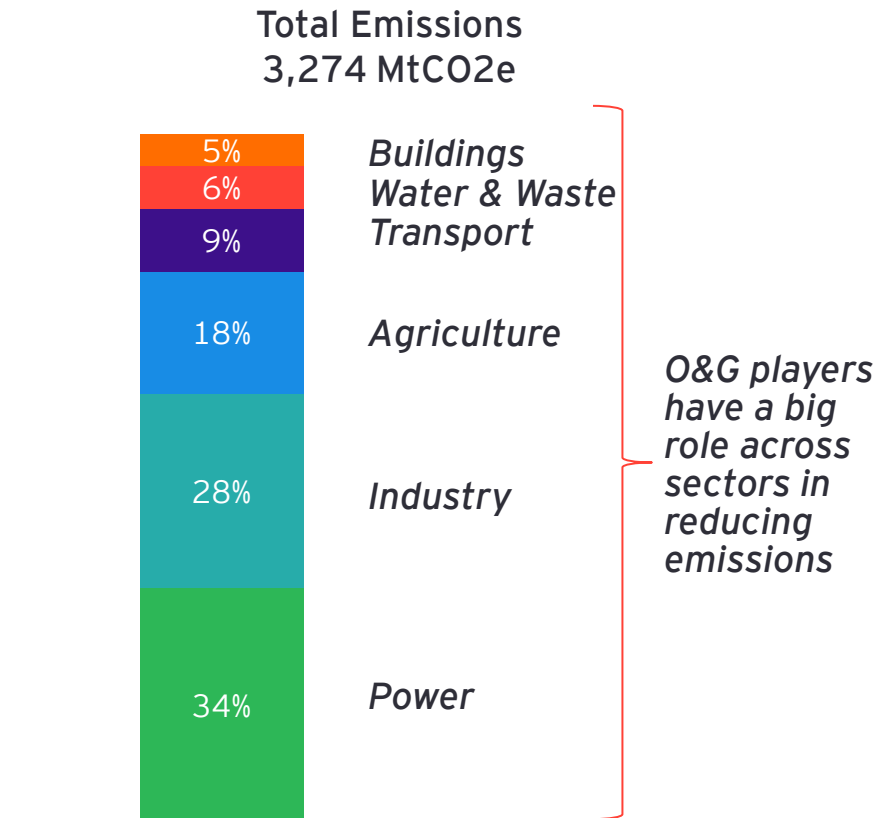
India's Focus on Climate Change

Ambition to Action

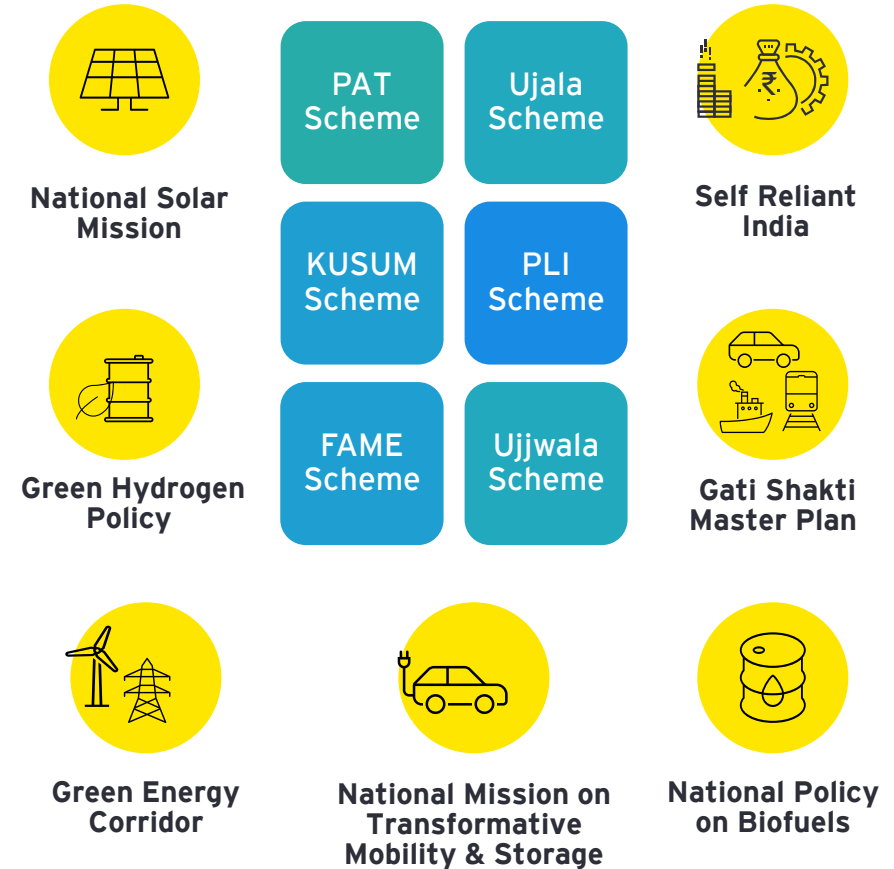
India's Targets and Commitments



India's current carbon emission mix



National Initiatives, Policies Aligned with Decarbonization



India's Journey Towards Net Zero - November 2021



WHAT IS NET ZERO?

Net zero refers to a balance where emissions of greenhouse gases are offset by the absorption of an equivalent amount from the atmosphere. Experts see net zero targets as a critical measure to successfully tackle climate change and its devastating consequences

INDIA'S 'PANCHAMRIT' AT COP26

by Prime Minister Narendra Modi

1. Reach non-fossil energy capacity to 500GW by 2030
2. Fulfil 50% energy requirements via RE by 2030
3. Reduce 1 bn carbon emissions by 2030
4. Reduce carbon intensity >45% by 2030
5. Achieve the target of Net-Zero by 2070



India's 2nd Nationally Determined Contribution to UNFCCC : Key Highlights (Aug 2022)

- India's updated NDC represents the framework for India's transition to cleaner energy for the period 2021-2030.
- Based on our national circumstances and the principle of **common but differentiated responsibilities and respective capabilities** (CBDR-RC), it reaffirms India's commitment to work towards a low carbon emission pathway, while simultaneously endeavouring to achieve SDGs.

1

Reduce emissions intensity of GDP by 45% by 2030 from 2005 levels

2

Achieve 50% cumulative electric power installed capacity from non-fossil fuel-based energy resources by 2030

3

Emphasis on changing lifestyle for the environment (the 'LIFE'), as a key in tackling climate change

4

Create an additional carbon sink of 2.5 to 3 billion tonnes of CO₂ equivalent through additional forest and tree cover by 2030.

Renewable Energy yet to catchup with Fossil Fuels : Energy Market Dynamics 2022



Renewable Energy Global Overview

Global CO₂

Energy-related emissions account for three-quarters of global CO₂ emissions

Modern renewables account for **12.6%** of total final energy consumption (2020)

135 countries have some form of net zero target, covering **88%** of global emissions

A rebound in economic activity led to a **6% increase** in CO₂ emissions in 2021

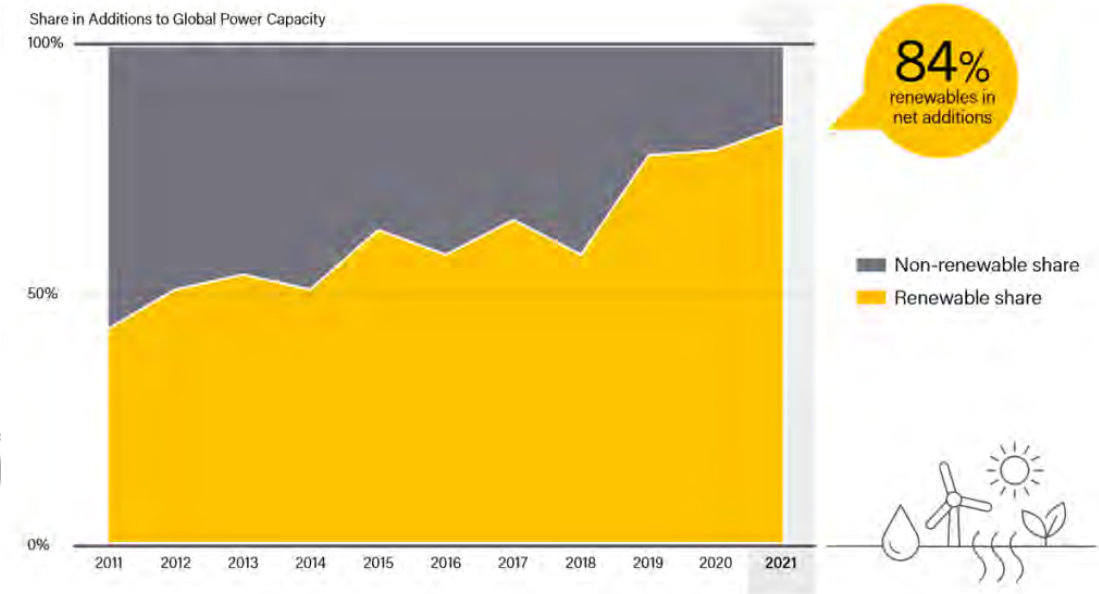
Total final energy demand grew **19%** between 2009 and 2019

USD 366 billion was invested in renewables in 2021

Fossil fuel subsidies reached **USD 5.9 trillion** in 2020

equivalent to **USD 11 million per minute**

At the 2021 UN climate summit, countries agreed to a **phase-down** of unabated coal power

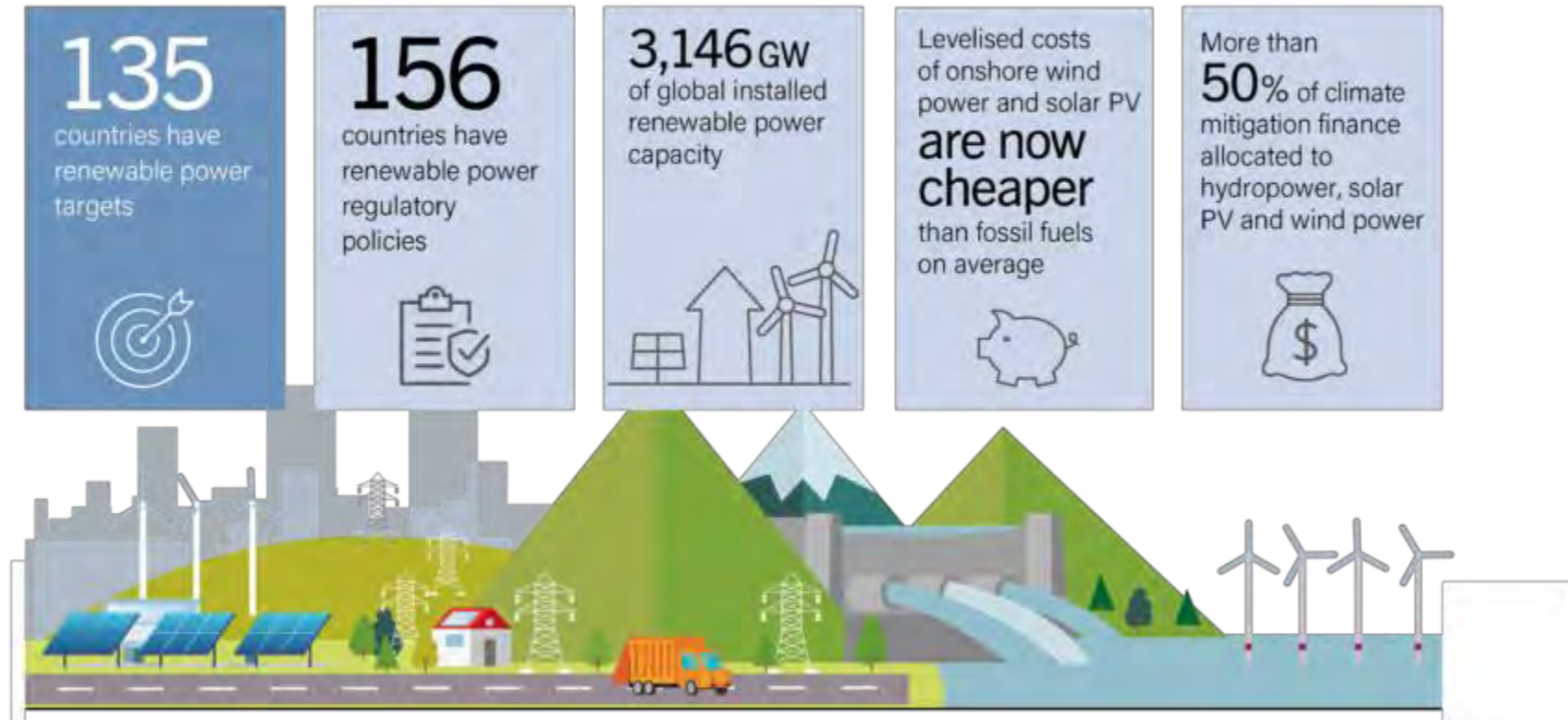


As of Jul 2022

Renewable Energy Statistics 2022 - Revealed By New Global Status Report (energytracker.asia)

World has witnessed significant growth in Renewable Energy Capacity though fossils fuels is still a dominant resource...

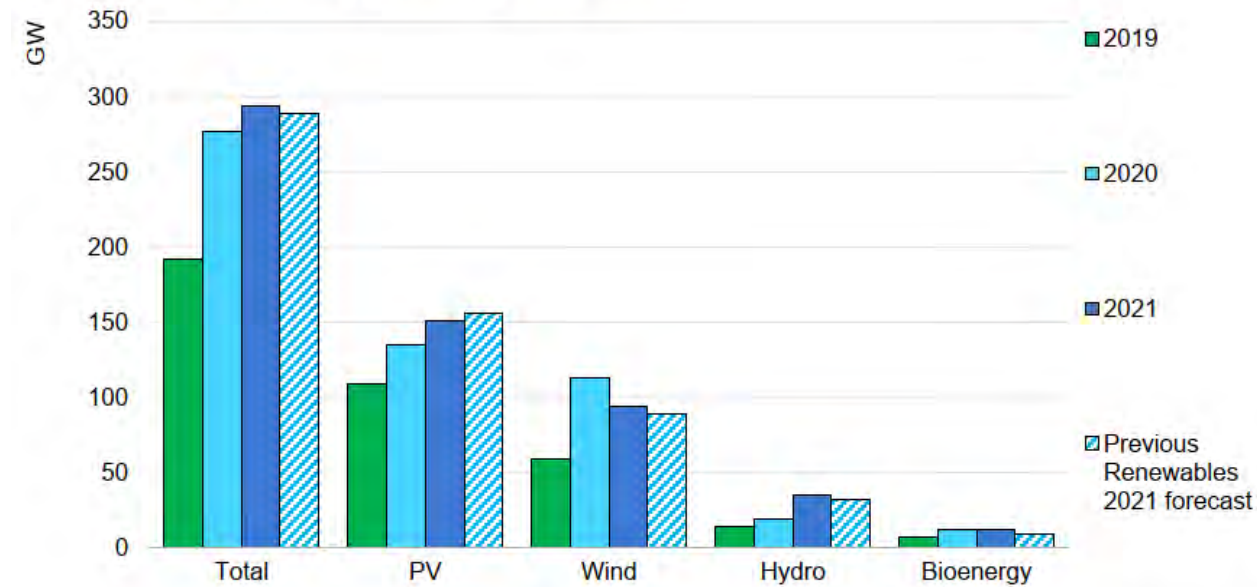
Renewables in Power



As of Jul 2022

World witnessed significant growth in Renewable Energy Capacity though fossils fuels is still a dominant resource...

Renewable net capacity additions, 2019-2021

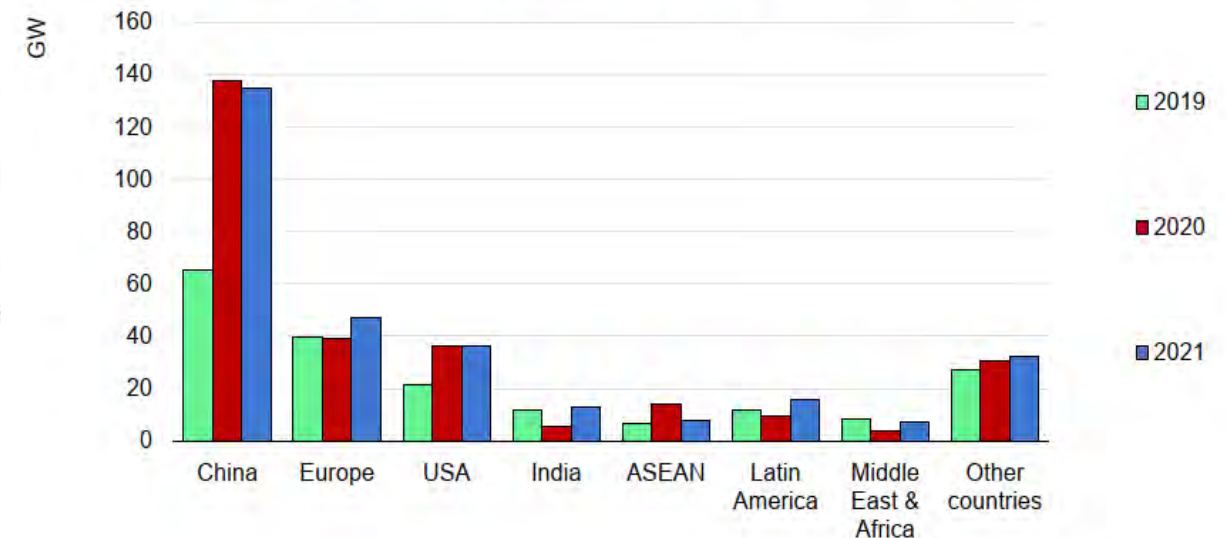


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Due to significant reduction in solar modules cost, solar installation capacity exceeded that of wind

China dominates RE net capacity additions

Renewable net capacity additions by country and region, 2019-2021

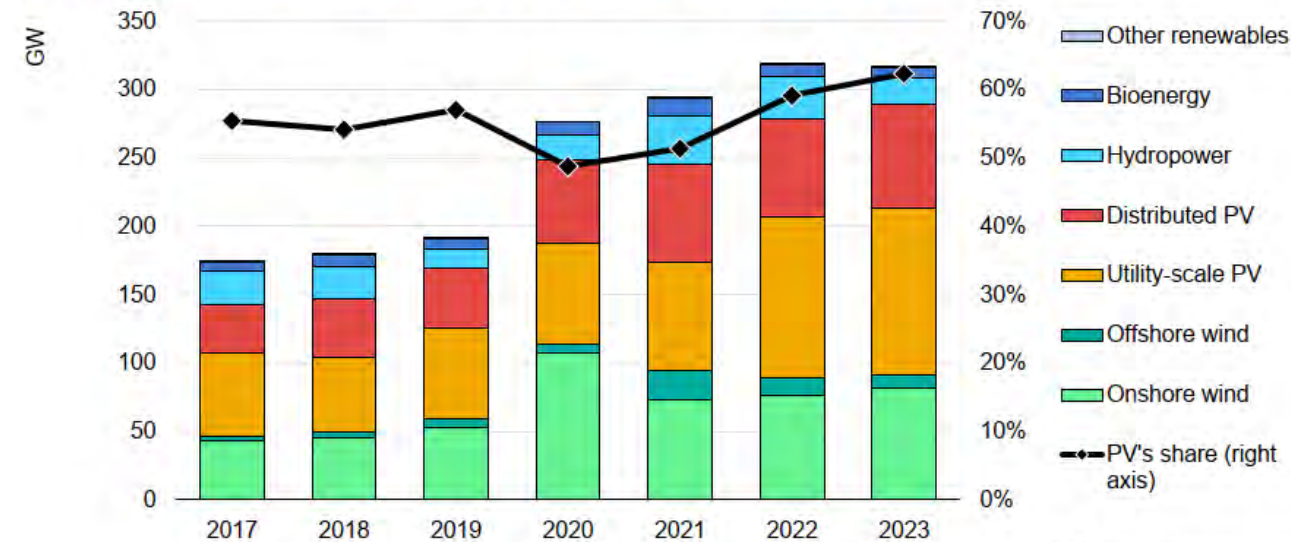


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Renewable Energy Market Update 2022 (windows.net)

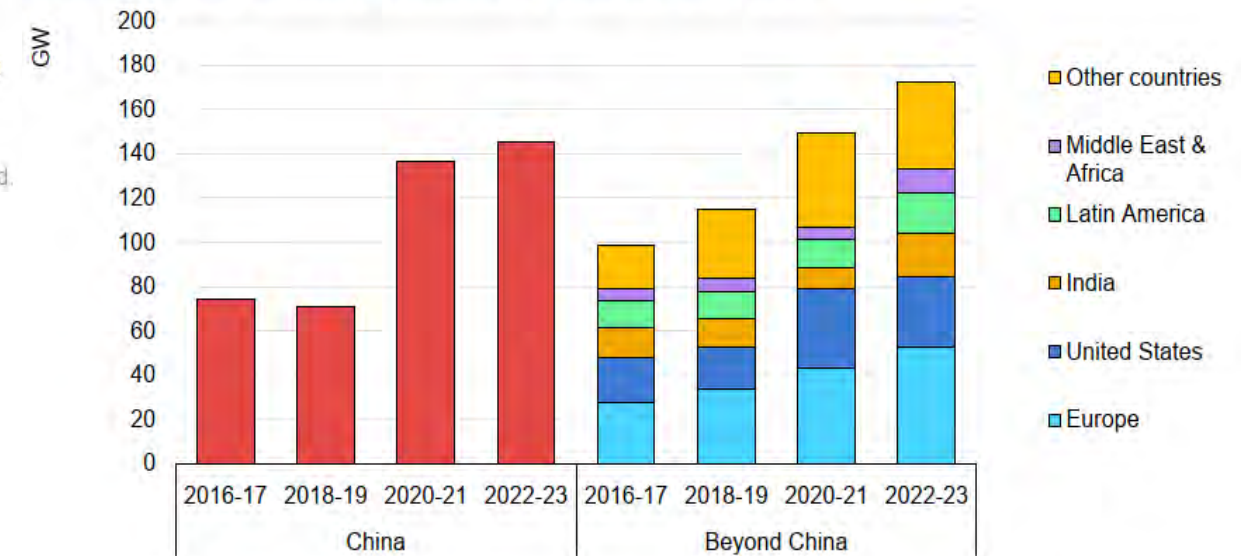
Solar and China synonymous in Renewable Energy growth while Distributed RE - PV emerges strong, globally

Net renewable capacity additions by technology, 2017-2023



RE capacity additions in China exceeds that of MEA, LA, India, US and Europe

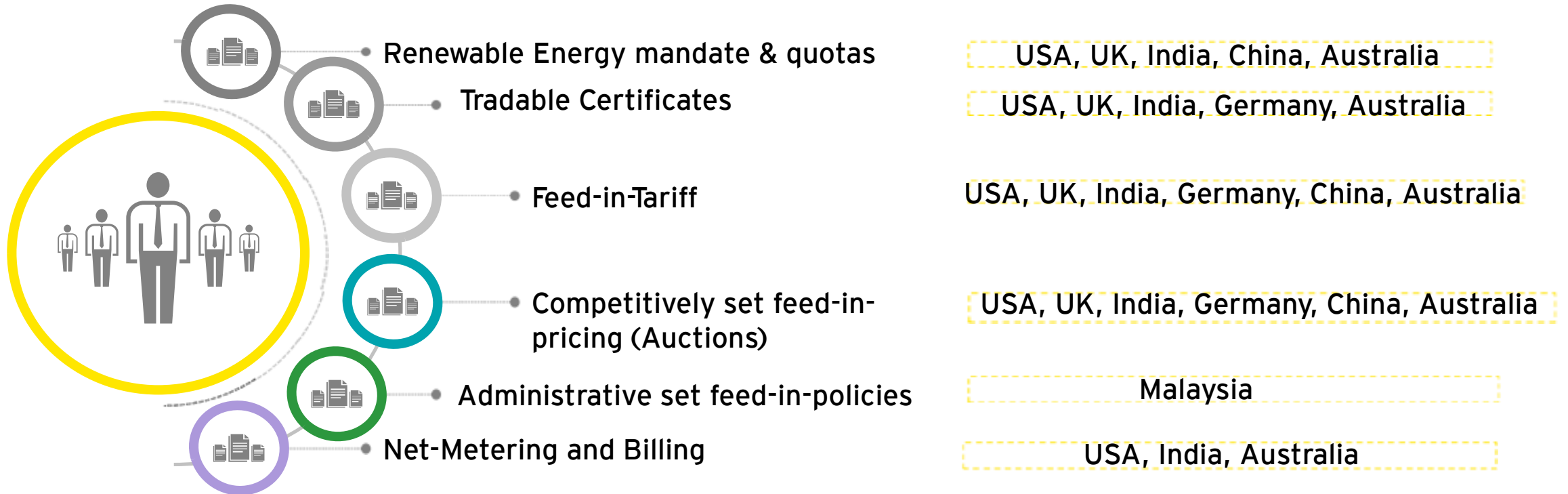
Annual average capacity additions by country and region



Solar dominates RE net capacity additions - DRE-PV picks up speed

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Policy Enabling Clean Energy Transition : Global Overview



Energy Transition leading to Decarbonisation: 4 R's orientation of energy companies towards decarbonization


1.Reduce: EV's Hydrogen, Renewables and energy storage

2. Reuse: Biofuels


3.Remove: Carbon Capture and Storage

4.Recycle: Polymer Recycling


India Clean Energy Transition : Areas of Key Focus




Energy efficiency




Renewable energy



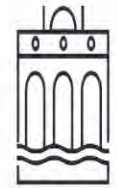
Circular economy




Biomass as fuel / feedstock




Hydrogen as fuel / feedstock



Carbon Capture Usage and Storage, CCUS

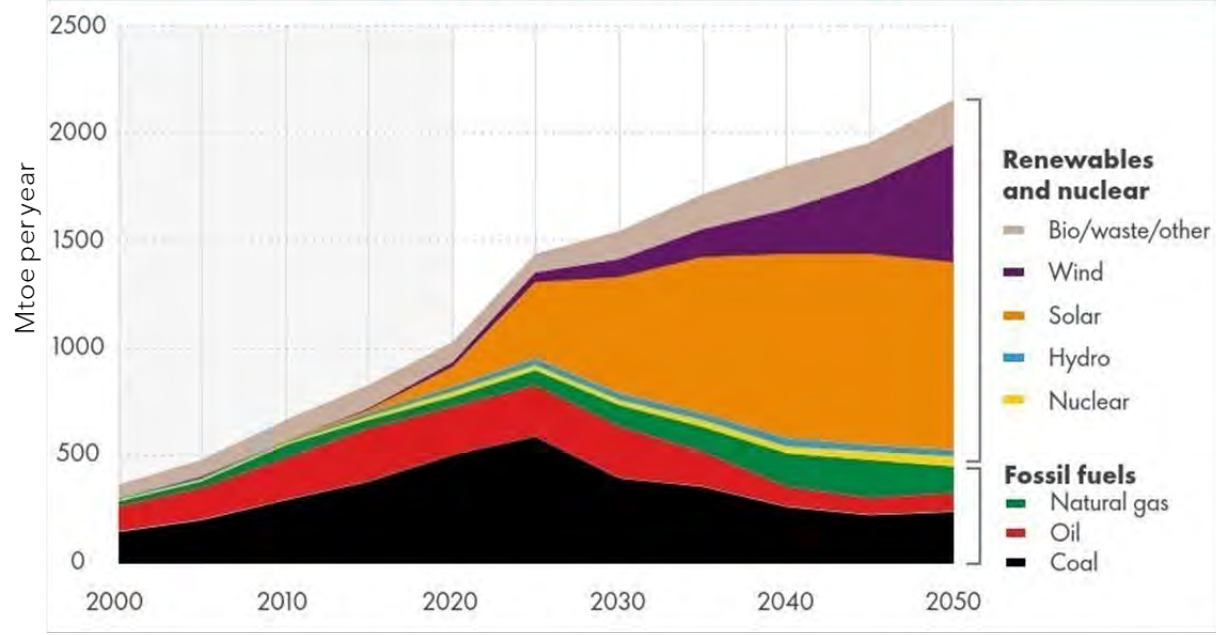


Electrification of heat



Other novel technologies

CCU, Hydrogen and Biofuels (apart from electrification and renewables) will have an important role for decarbonization of India's economy.



- ✓ Solar becomes the dominant energy source in the late 2030s
- ✓ Crude oil peaks around 2030 but declines after that as EV permeates transport
- ✓ CNG use in transport declines in the 2040s as electrification and hydrogen take hold.
- ✓ No additional coal-based power generation capacity is installed after 2030

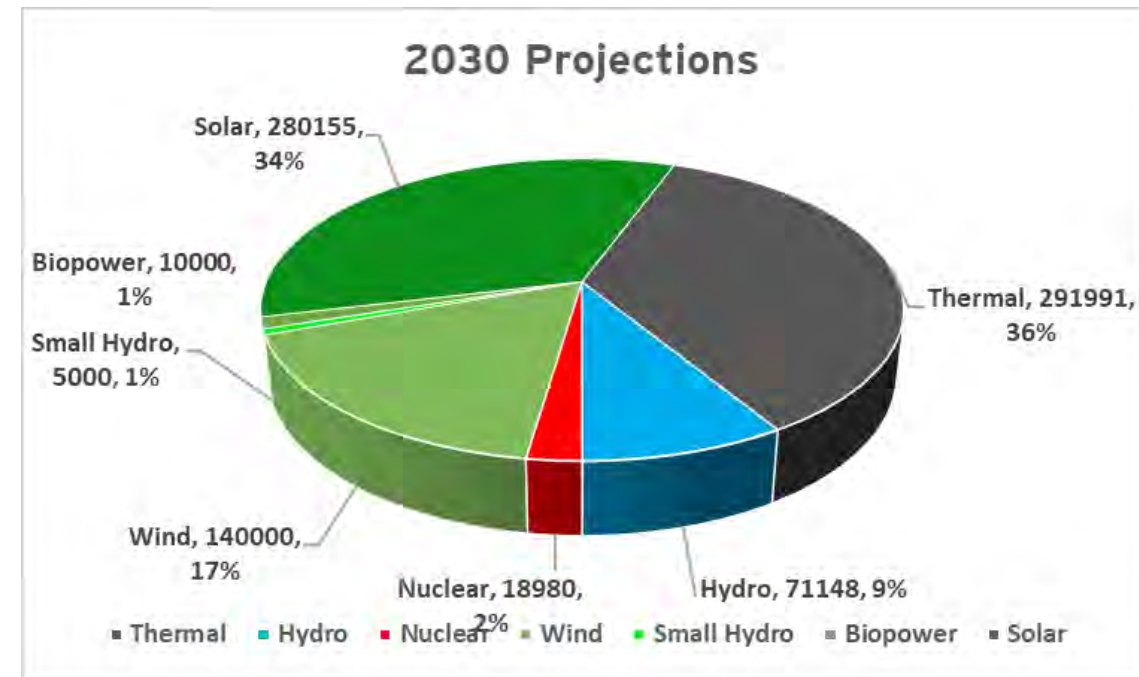
India has witnessed significant growth in Renewable Energy Capacity though Coal is still a dominant resource...

Total Capacity : 408714.84 MW



Renewable Energy (RE) - 119 GW (Oct '22): 29%
If we consider large hydro under RE : 40 %

Total Capacity : 817254 MW



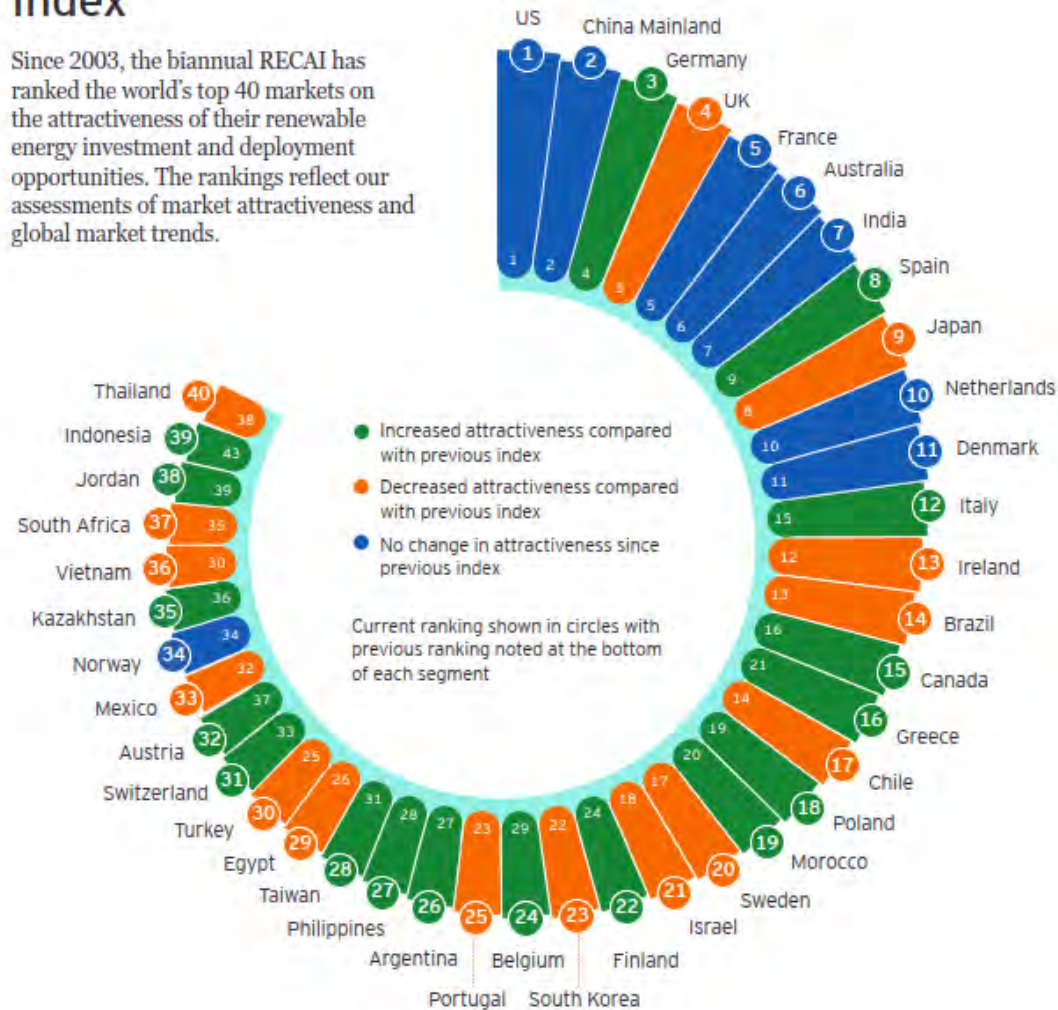
Renewable Energy (RE) - 119 GW (end '30): 53%
If we consider large hydro under RE : 62%

India retains (7th) position in EY Renewable Energy Attractiveness Index - 2022 but improves several notches on PPA Index ...(Nov' 22)

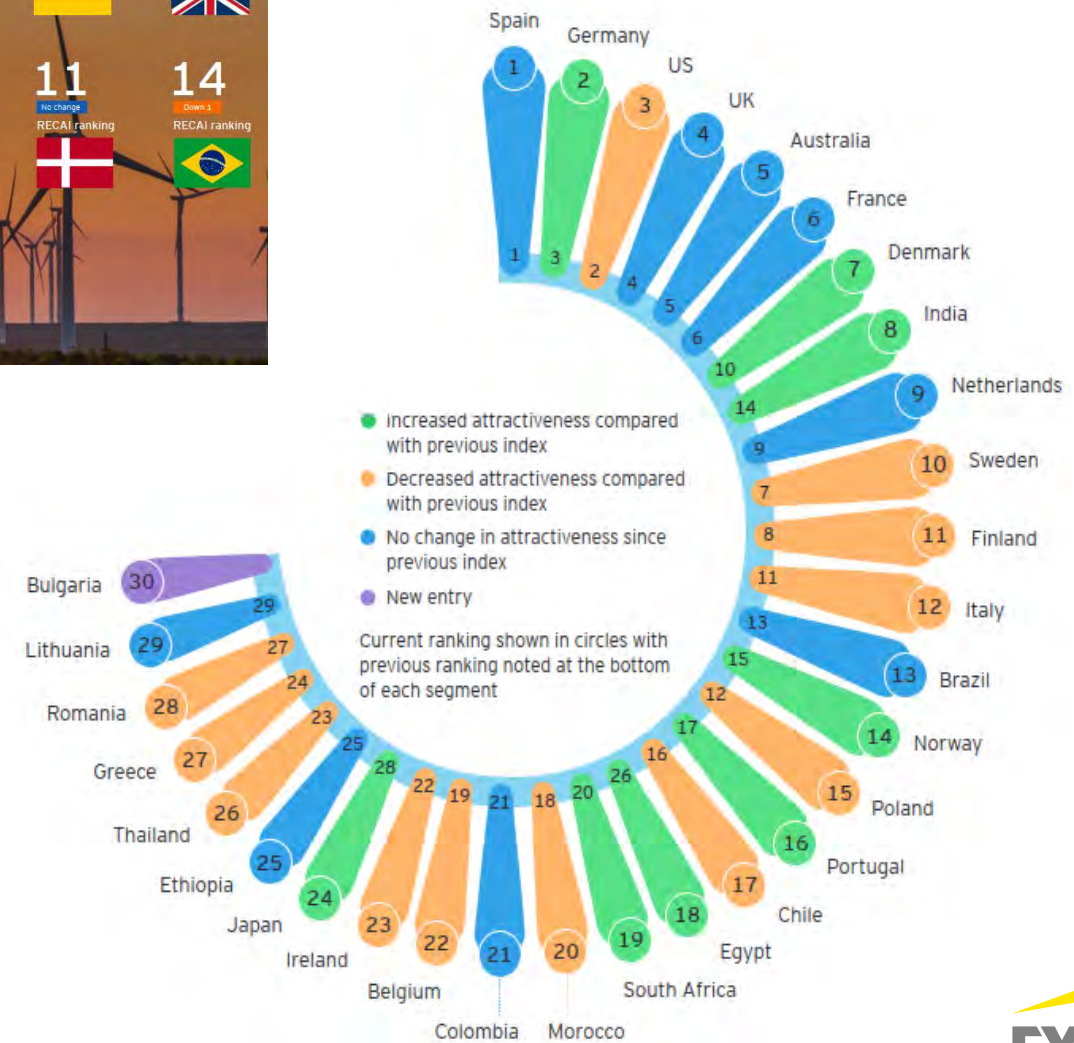
RECAI 60

Index

Since 2003, the biannual RECAI has ranked the world's top 40 markets on the attractiveness of their renewable energy investment and deployment opportunities. The rankings reflect our assessments of market attractiveness and global market trends.



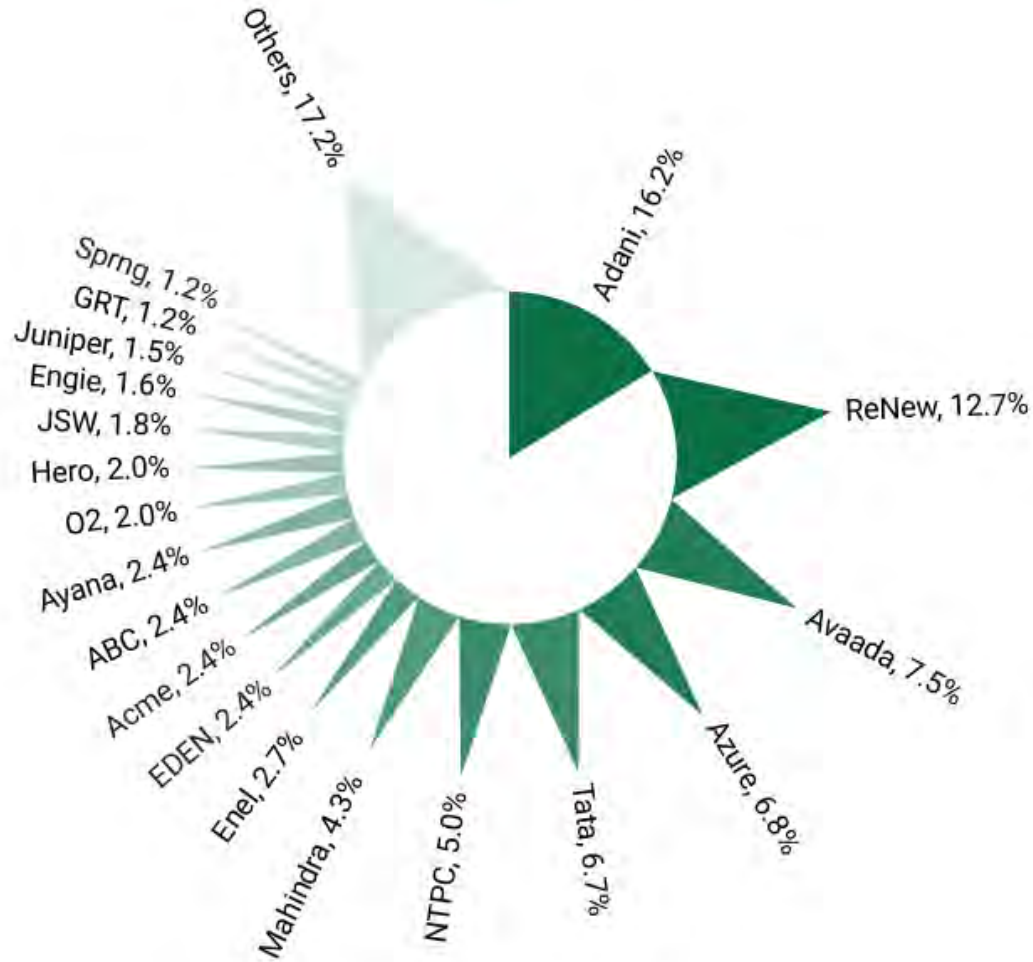
PPA Index



Solar project developers and EPC players have increased in India thanks to auctions and open access...

(Jun'22)

Project developers - 12,532 MW

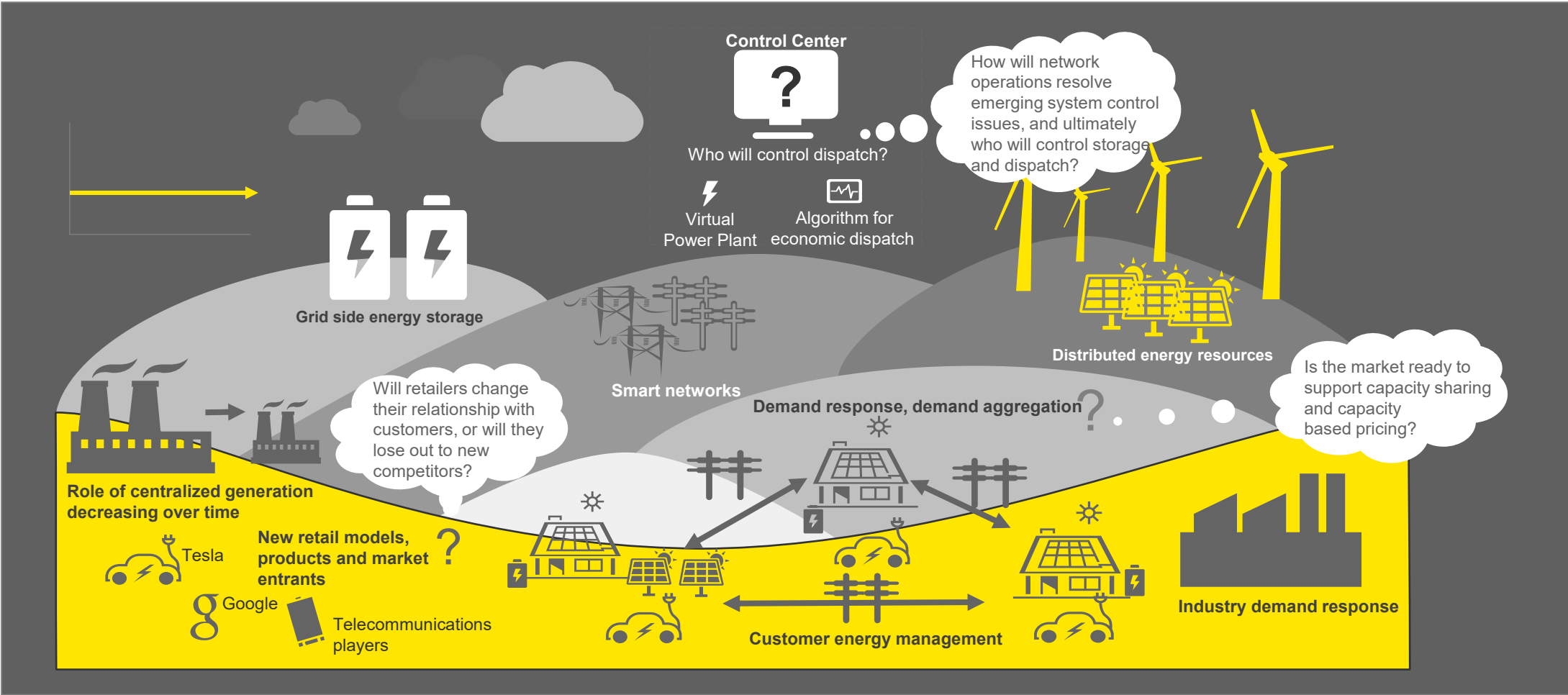


Solar EPC contractors - 11,314 MW

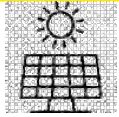


World-over, traditional energy value chain is undergoing unprecedented disruption : 3Ds (Digitalization, Decarbonization & Decentralization) 4th D ?

Future of power ecosystem



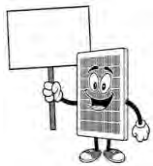
Current Status: Rooftop Solar (RTS) in India



10.22 GW Installed Rooftop Solar Capacity
(30th June, 2022)



40.00 GW Target under National Solar Mission
(By 2022)

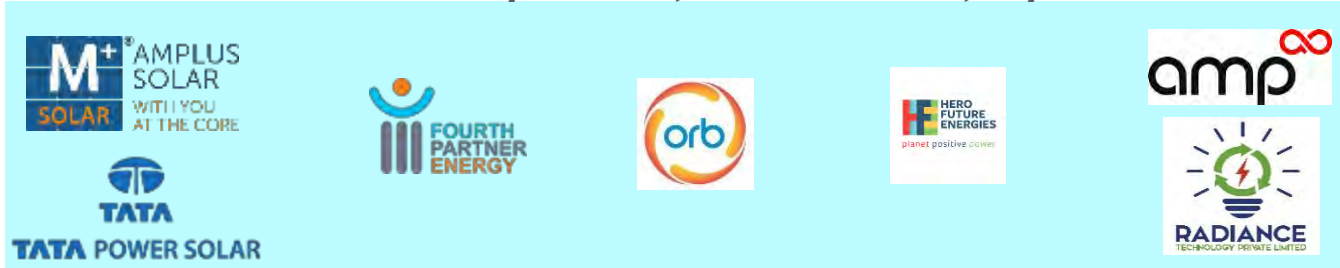


2.5 GW Rooftop solar added Jul '21-Jun '22

States Leading Rooftop Solar Installations (~40% of total RTS)

- Gujarat (2330 MW)
- Maharashtra (1372 MW)
- Rajasthan (859 MW)
- Tamil Nadu (717 MW)
- Andhra Pradesh (515 MW)

Key Developers / RESCO players



Total installed capacity: 10,221 MW^{1,2}
as on 30 June 2022



CAPEX remains the most popular form of project development

Key EPC players



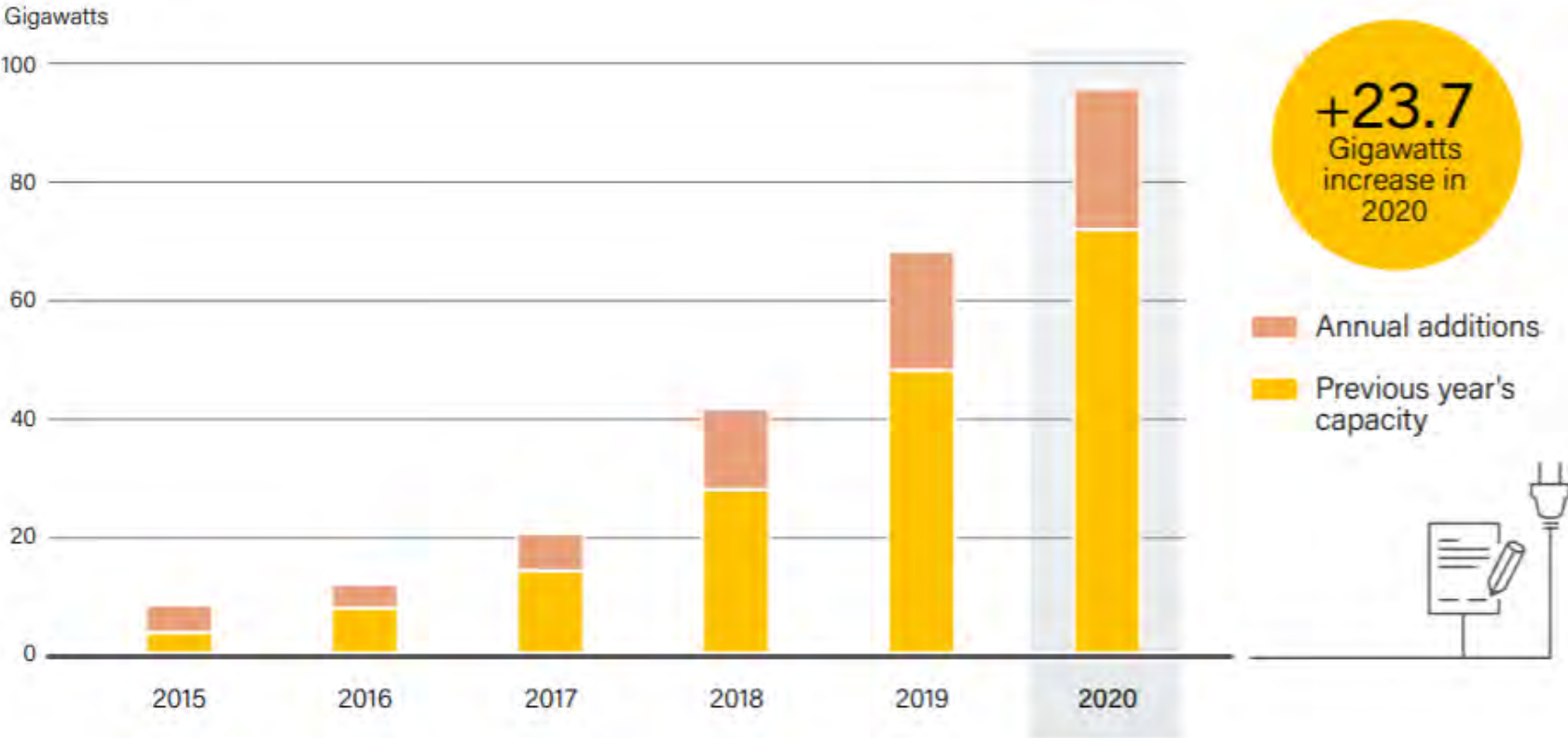
Renewable energy corporate procurement continues to increase and is encouraging...

Drivers

- Cost Savings & Competitiveness
- Risk Mitigation
- Business Coalition
- GHG Emission Reductions

Corporate Sourcing

- Self-generation and consumption
- Power Purchase Agreements
- Utility Green Procurement
- Environmental Attribute Certificates

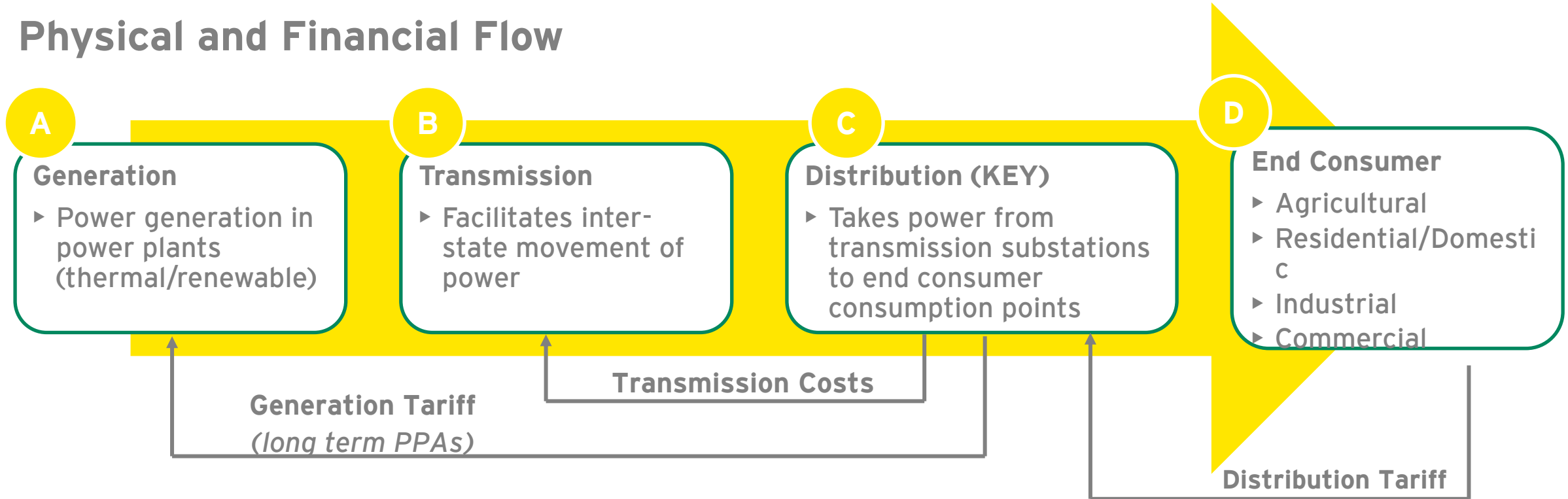


Note: Data are provided in direct current (DC) and do not include on-site power purchase agreements (PPAs).

Despite a challenging business environment due to COVID, capacity of new renewable corporate PPAs sourced by businesses worldwide increased 18% in 2020 and 24% in 2021 (31 GW - BNEF)

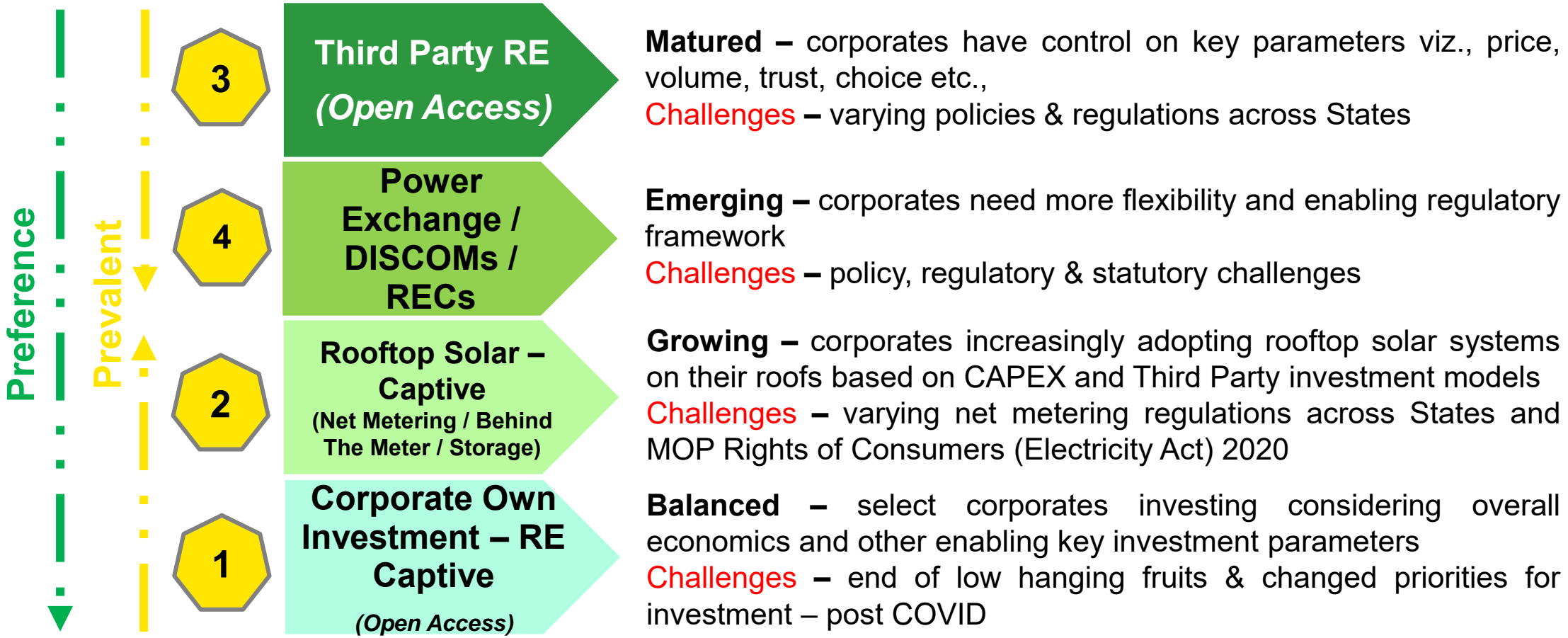
Corporate Renewable Energy Procurement - Key Flows

Physical and Financial Flow



Corporates have significant reliance on A, B & C and are impacted due to changes, though market modes are emerging (Exchange and RECs)

Corporate RE Procurement : RE Migration Options - Economics



Corporate RE Procurement : RE Migration Options - Economics

Captive - Open Access (OA)

1. OA Charges – waived
2. Net Payment to DISCOM
3. Tax Breaks
4. Group Captive - shareholding linked

1

3rd Party - Open Access (OA)

1. OA Charges - waived
2. Net Payment to DISCOM
3. CSS and additional surcharge
4. Differential (tariff) is the decision enabler

2

Rooftop Solar

1. Gross Metering
2. Net Metering
3. Savings – 50%-70%
4. Differential (tariff) is the decision enabler

3

Corporate RE Procurement (CRP) - Way Forward

Target Setting & Business Models

- ▶ Ambitious, long term with short to medium term milestones based on extensive baseline assessment
- ▶ Extensive assessment of policy and regulatory risks
- ▶ Cost economics to be worked out based on various scenarios (location, HQ policy etc.,)
- ▶ Systematic and streamlined longer term **vision**

Negotiations and Risks

- ▶ Internal and external negotiations, key
- ▶ Comprehensive risk assessment and profiling essential considering various parameters in play
- ▶ SWOT analysis and Risk Mitigation Plan, key

**Corporate RE Procurement
can significantly aid India
to achieve RE & Nationally
Determined Contribution
Target**

Policy & Regulations (P&R)

- ▶ Need uniform and long term / consistent policies and regulations to instil confidence on CRP
- ▶ Minimize RE curtailment – compensate losses
- ▶ Fair Open Access framework with rationalized charges – GOAR launched by CERC
- ▶ Ensure enforcement of P&R

Operational Challenges

- ▶ Standardize tax, levies & charges
- ▶ RE+Hybrid + Storage options
- ▶ Ensure multiple avenues for CRP

Barriers to Scale Renewable Energy



Policy & Regulatory

- ▶ Green Corridor & Charges
- ▶ DISCOMs unwillingness
- ▶ Open Access Framework
- ▶ Net Metering
- ▶ Captive Power
- ▶ Behind The Meter
- ▶ Overall implementation inconsistency



Technology Options

- ▶ Technology disruptions
- ▶ Variability in generation
- ▶ Slow deployment
- ▶ Quality, Performance related issues
- ▶ Grid access, evacuation, storage and balancing
- ▶ Infrastructure upgradation



Financial

- ▶ Few FIs & Banks and Limited players with access
- ▶ Hedging risk
- ▶ Non-standard & renegotiated PPAs
- ▶ Payment delays
- ▶ Change in costs of procurement - short term impacts



Other Key Barriers

- ▶ Land acquisition and local clearances & approvals
- ▶ Limited Workforce
- ▶ Awareness creation
- ▶ Stakeholders' engagement

Key Risk Impacting Investors

Currency Risk

Off-Taker Risk

RoI Risk

Asset Risk

Capital Risk

Evolving Policy Landscape

Mitigators to Scale Renewable Energy

Currency Risk

- Hedging Solution
- Dollar Tariff Policy

Off-Taker Risk

- Payment Security Mechanism
- Infrastructure Debt Funds
- Debt Restructuring

Return on Investment Risk

- Infrastructure Investment Trusts (Inv-ITs)

Asset Risk

- Partial Credit Guarantee Mechanism

Capital Risk

- Green Bonds
- Green Banks

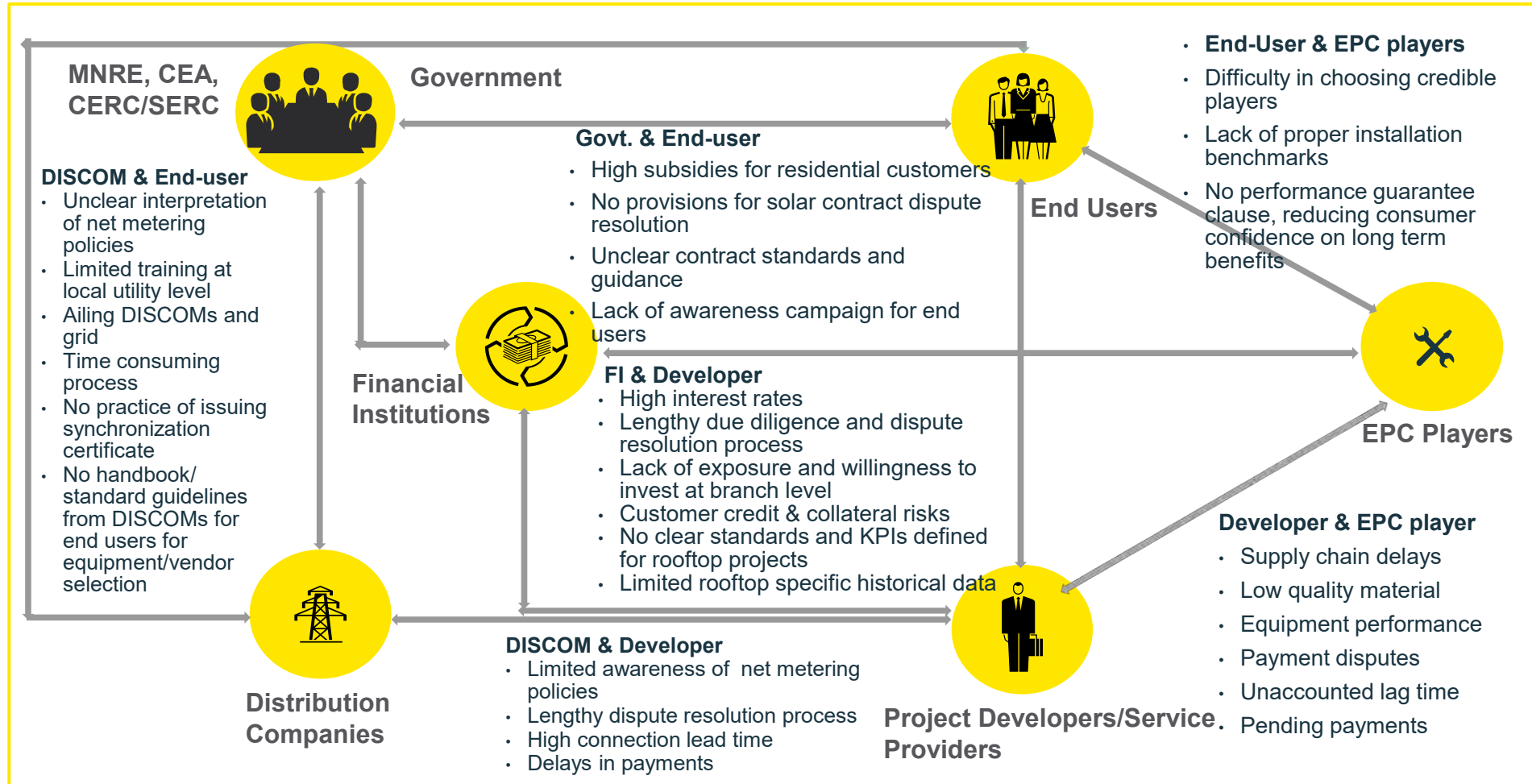
Evolving Policy Landscape Risk

- Structured PPA
- Centralized Off-Taker (SECI)

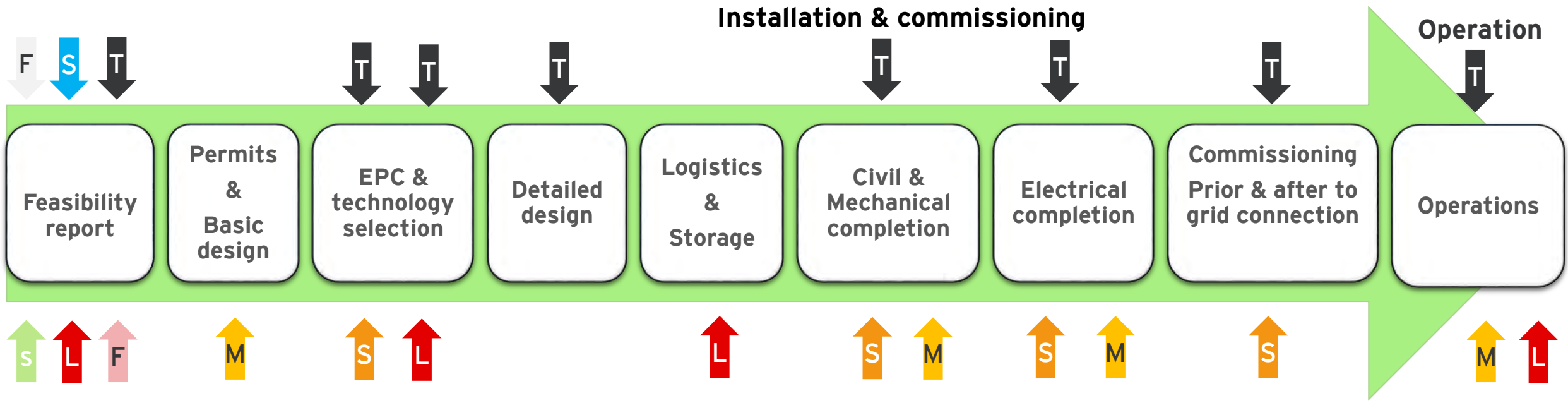
- Insurance - specific risk coverage

- Carbon Credits

Key challenges faced by Rooftop Solar sector in India



Barriers to Scale Rooftop Solar



Planning & Development

Class of Risk	Name of Risk
1	Site specific risk
2	Safety risk
3	Management risk
4	Logistic risk

Class of Risk	Name of Risk
5	Financial risk
6	Geo- political risk
7	Legal risk
8	Technical risk

Key Challenges for Rooftop Solar: Growth Slows Down in 2022

Discouraging Govt. Policies

- BCD & DCR – ALMM – NEM
- Increase in Costs – 2015-16 levels
- GOAR – impact yet to be seen but consumers wait & watch mode

1

Regulatory & DISCOMs' Hurdles

- DISCOMs still averse to C&I adopting GRPV
- DISCOMs delay in implementing streamlined IC process
- SERCs adhoc rulings impacting RESCOs' business

2

Supply Chain Issues

- Demand for Modules
- Higher lead time
- Supply chain affected – BOS prices down
- Hike in GST – consumer unacceptance

3

Weak consumers credit profile and dispersed nature

- RESCOs exhausted low hanging fruits
- Challenges in operating across geographies
- PPA risks – low tariff by locals / quality control issues

4

Enforceability of contractual obligations

- Inability to ensure rooftop rights for long period
- Issues in enforcement of lease agreements & PPA

5

Technical Issues

- ALMM – non availability of high wattage panels
- Incompatibility – low wattage panels with modern inverters
- Battery Storage expensive and nascent
- Standardization of RTS package for comparison

6

Key Interventions to Accelerate Rooftop Solar Uptake - Financing

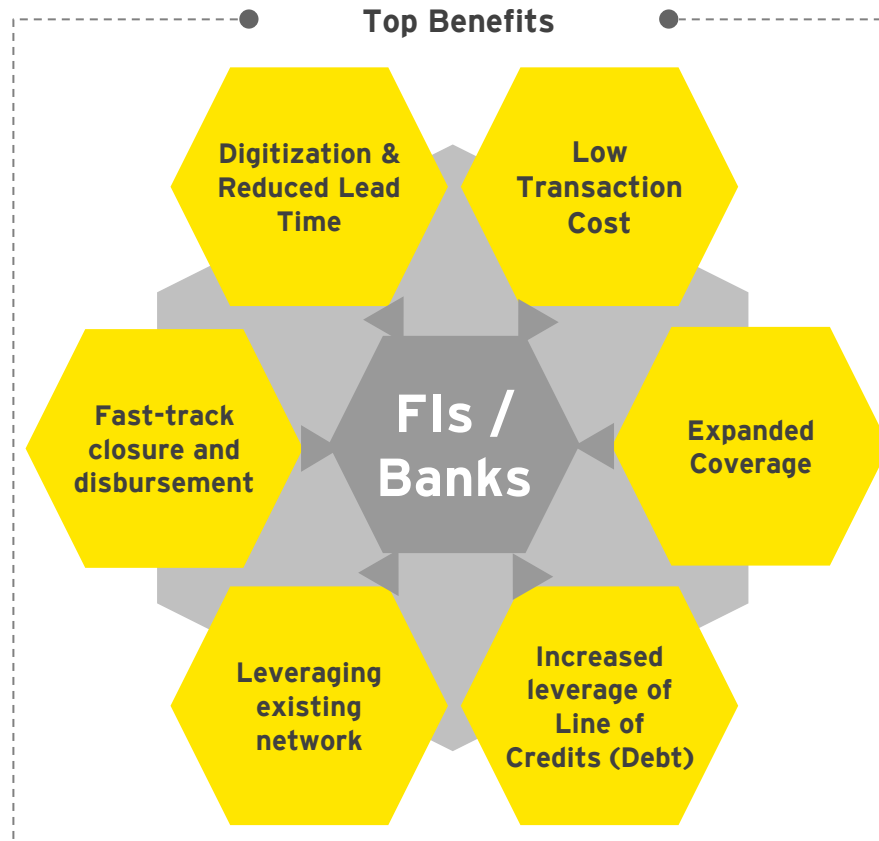
Need for multiple channels ...

... increasing focus on deals

Ease of Business for RESCOs

New Product Creation for smaller capacities

Engaging with MNRE, Utilities, RESCOs, EPCs & NBFCs for Resi



Engaging with large Corporate Borrowers

Engaging with NBFCs & HFCs Co-Lending - PSL

Solar Municipal Bonds For Residential Solar Rooftops

Urban Local Bodies (ULBs) can collaborate with RESCOs in deploying projects via 3rd party financing & issue Solar Bonds

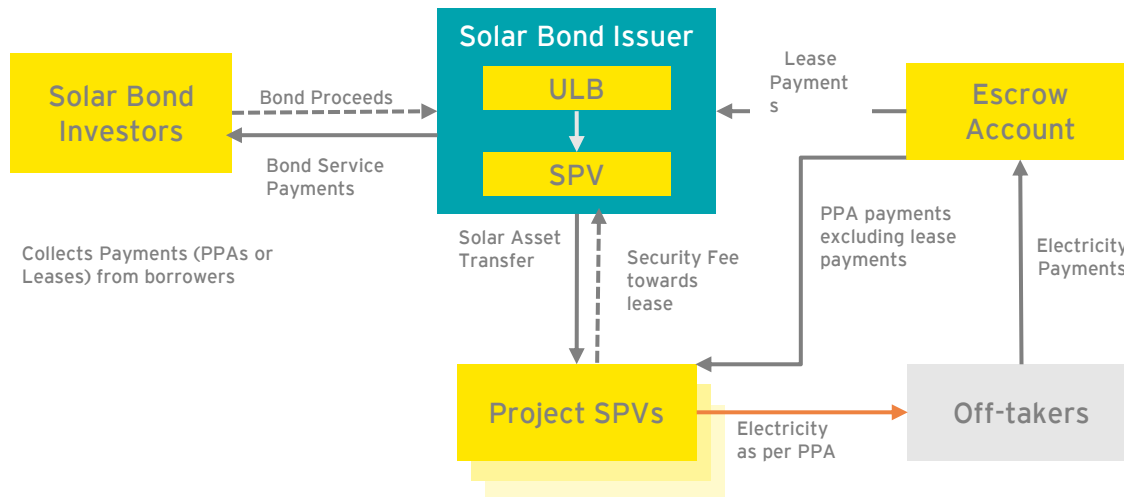
Benefits of Solar Finance Securitization

- ULBs already have RE targets under Solar under smart city mission
- ULBs have better credit ratings when compared to most SME RESCOs & also benefit from state guarantees
- Solar Bond issue builds ULB capacity to access debt capital markets for other projects & help them in lower cost of financing
- Subscription to Solar Bonds can tap a broader base of capital - pension funds & Institutional Investors

Current challenges in Solar Finance Securitization

- No statutory mandate for ULBs to promote electricity generation
- SMBs need to achieve high credit ratings. India has had limited success with municipal bonds due to poor state of ULBs.
- Current regulations mandate ULBs to provide min. equity contribution of 20% of the project cost. Absence of supporting regulations will hinder ULBs to act as a financial company
- ULB structural issues & inertia of doing something new

Structure of Solar Municipal Bond Model



Through Smart Cities Mission, GoI has encouraged cities to delve into the municipal bond market

Pune municipal corporation successfully issued Municipal bonds @7.59% in 2017

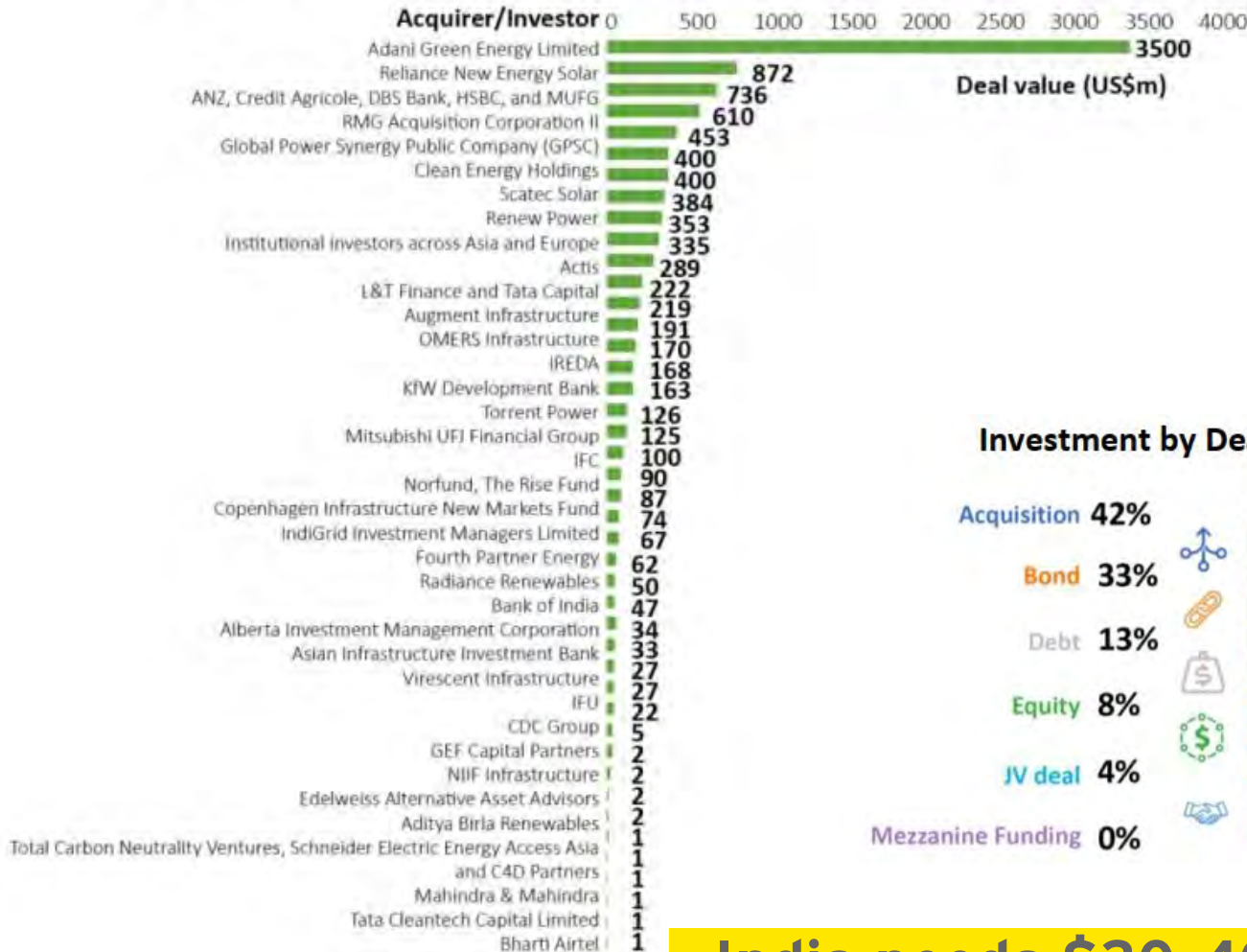
Action items for launching Solar Municipal Bonds

- Introduction of amendments to allow ULBs to facilitate electricity generation & act as financiers for clean energy generation projects
- Potential & current off-taker data collection to evaluate sustainability & efficiency for good solar bond rating
- Contract standardization, for minimizing cost of bond issue
- Supporting/enabling policies from states/agencies & regulators

Source: US Dept. of Energy, NREL, CPI

Investments in RE in India has surged post COVID...more in solar

Key Investors in Renewable Energy FY2021/22



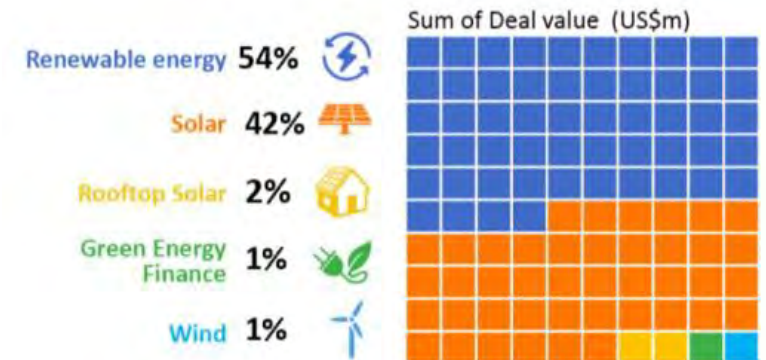
Renewable Energy Investment Since FY2019/20



Investment by Deal Type FY2021/22



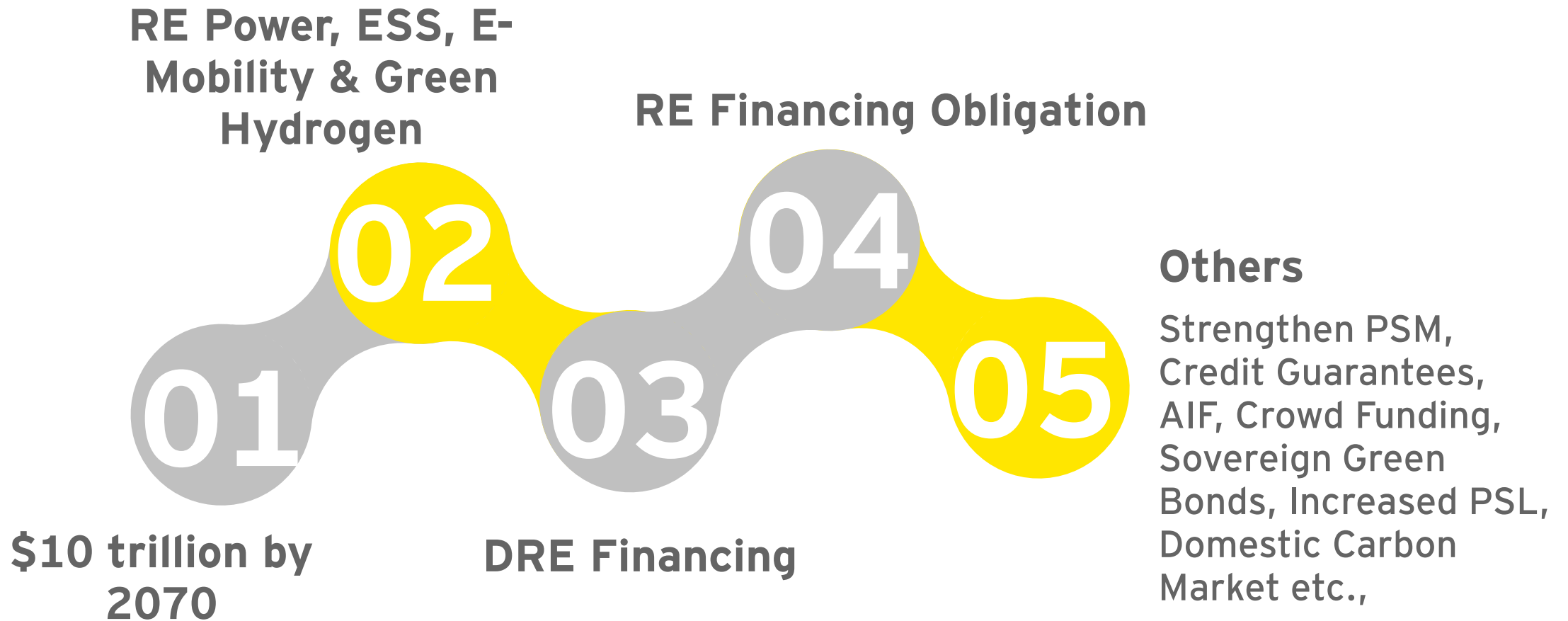
Investment by Sector Type FY2021/22



India needs \$30-40 bn per year to achieve 450 GW by 2030 (PA Goal)

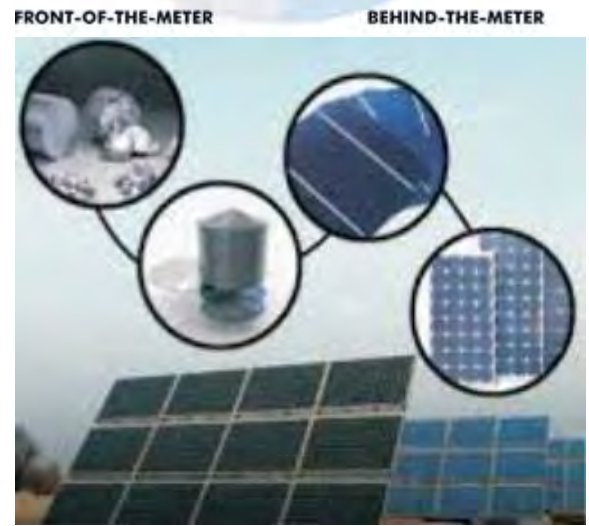
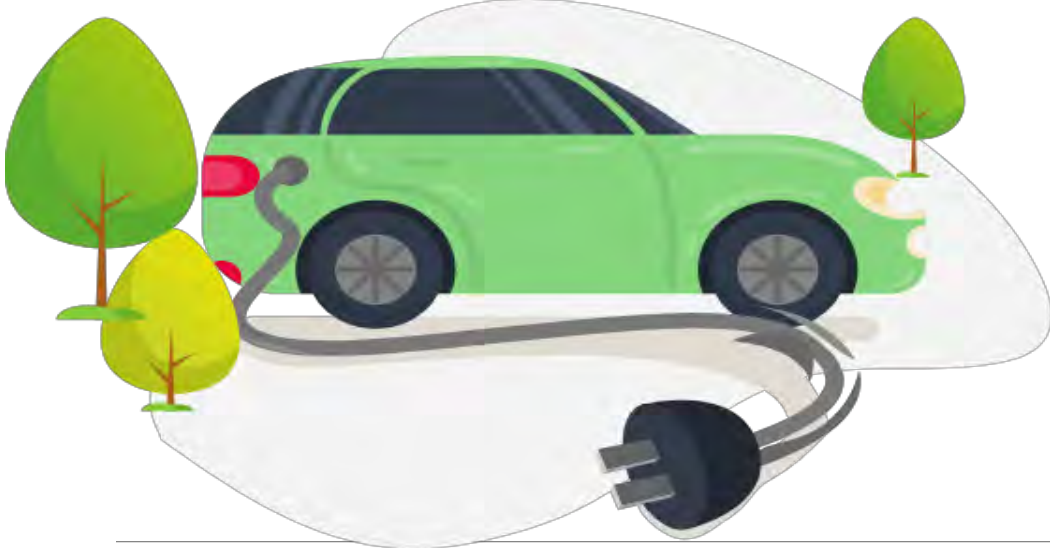
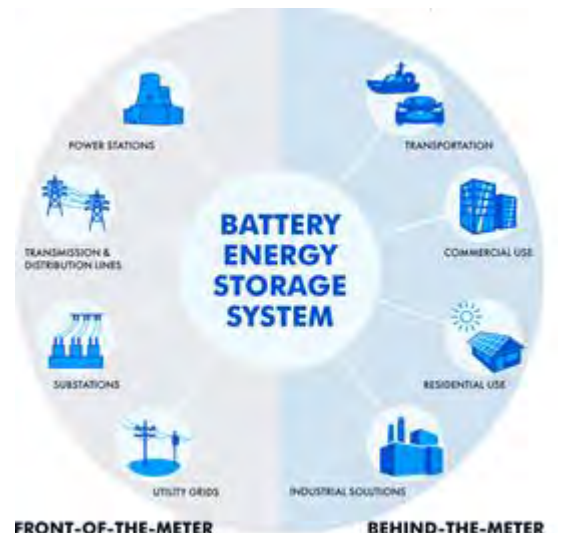
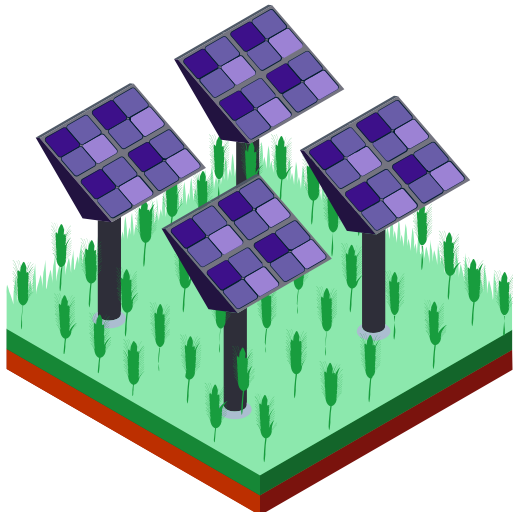
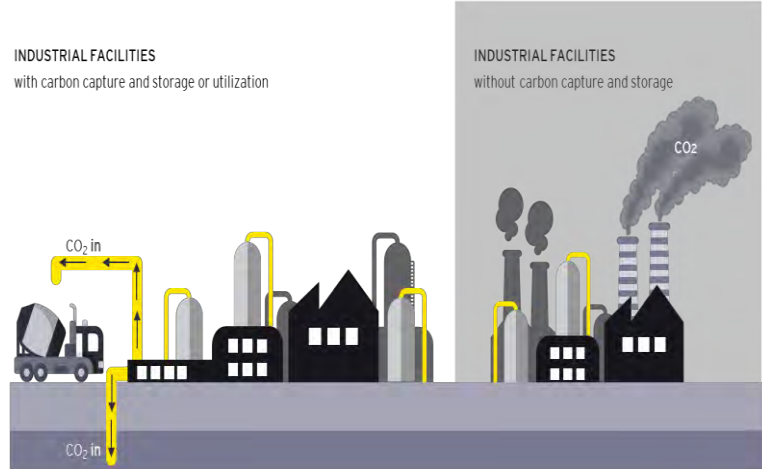
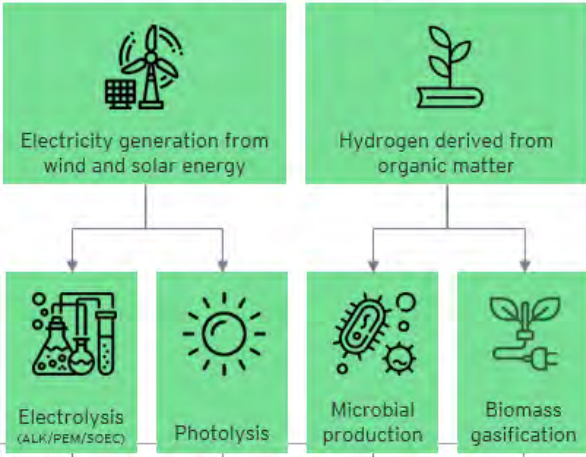
Source:JMK Research

India needs trillions of \$ to achieve Net Zero by 2070....



Watch out for these emerging clean energy technologies....

Green Hydrogen



Thank you !

Nithyanandam Yuvaraj Dinesh Babu

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Email: Yuvaraj.Dinesh@in.ey.com

Mobile:9560719349

Economy Watch

Indian economy by 2050: In pursuit to achieve the \$30 trillion mark

India to reach US\$5, 10, 20 and 30 trillion by FY27, FY34, FY43 and FY48, respectively.