

ENERGY FINANCE CONFERENCE

IIT Madras, August 2019



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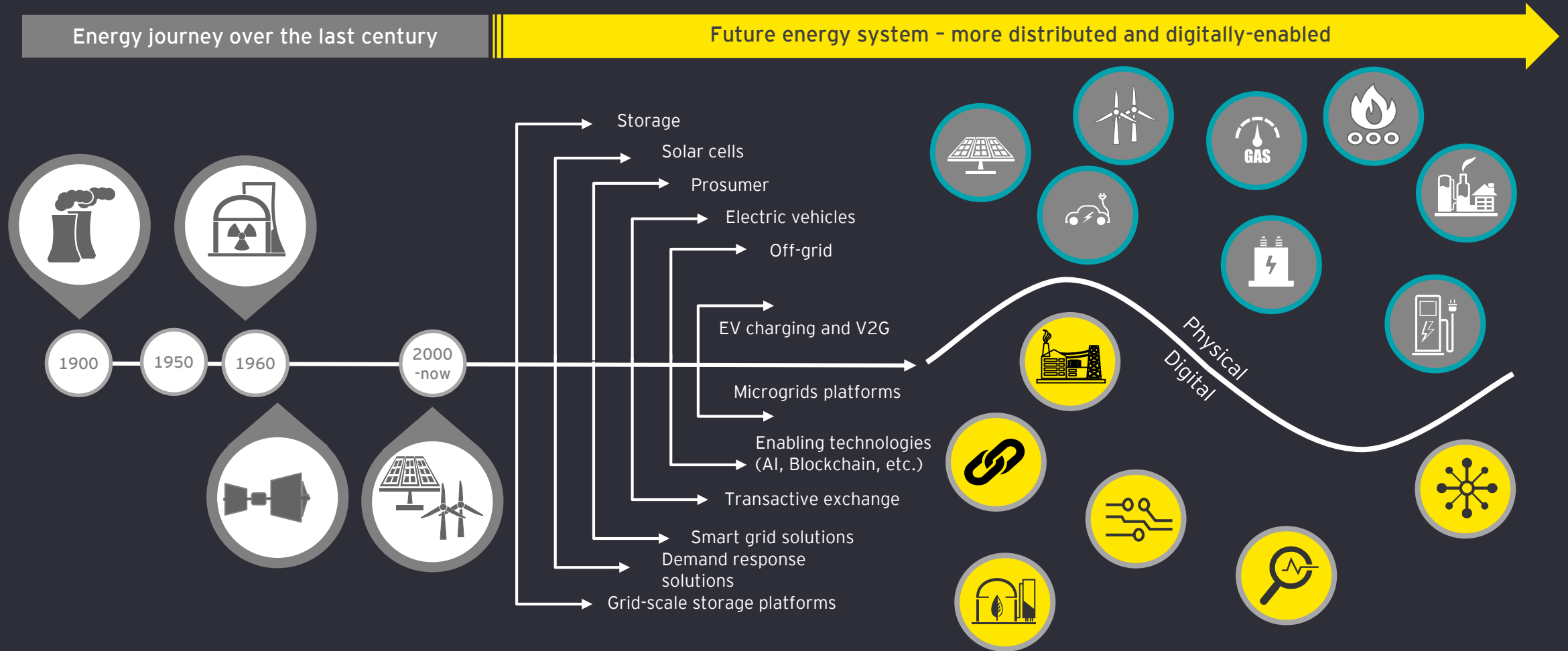


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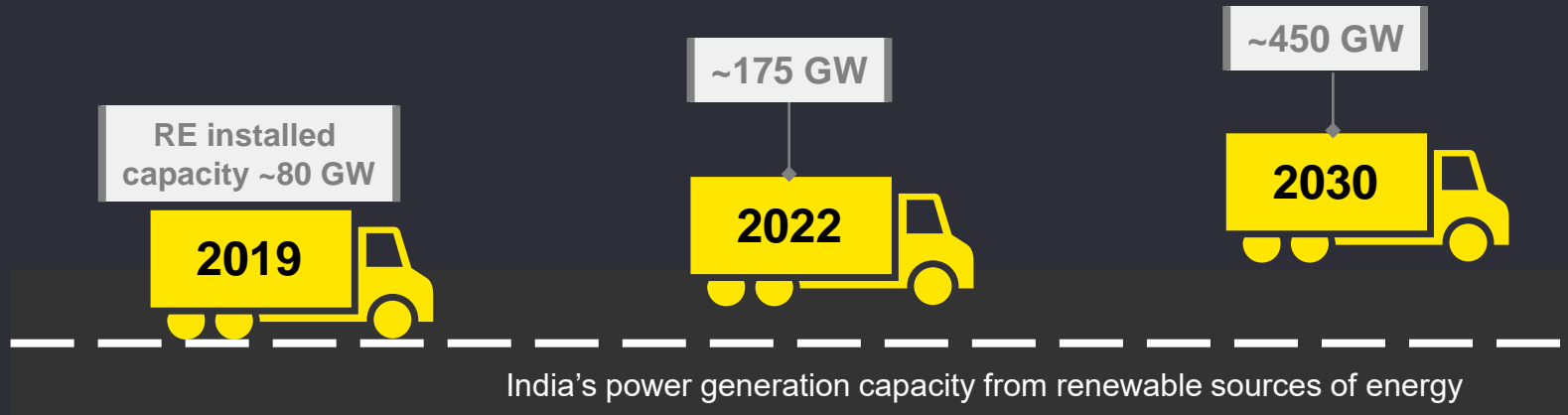
Building a better
working world

Changing energy landscape - more decarbonized, distributed and digitized than ever

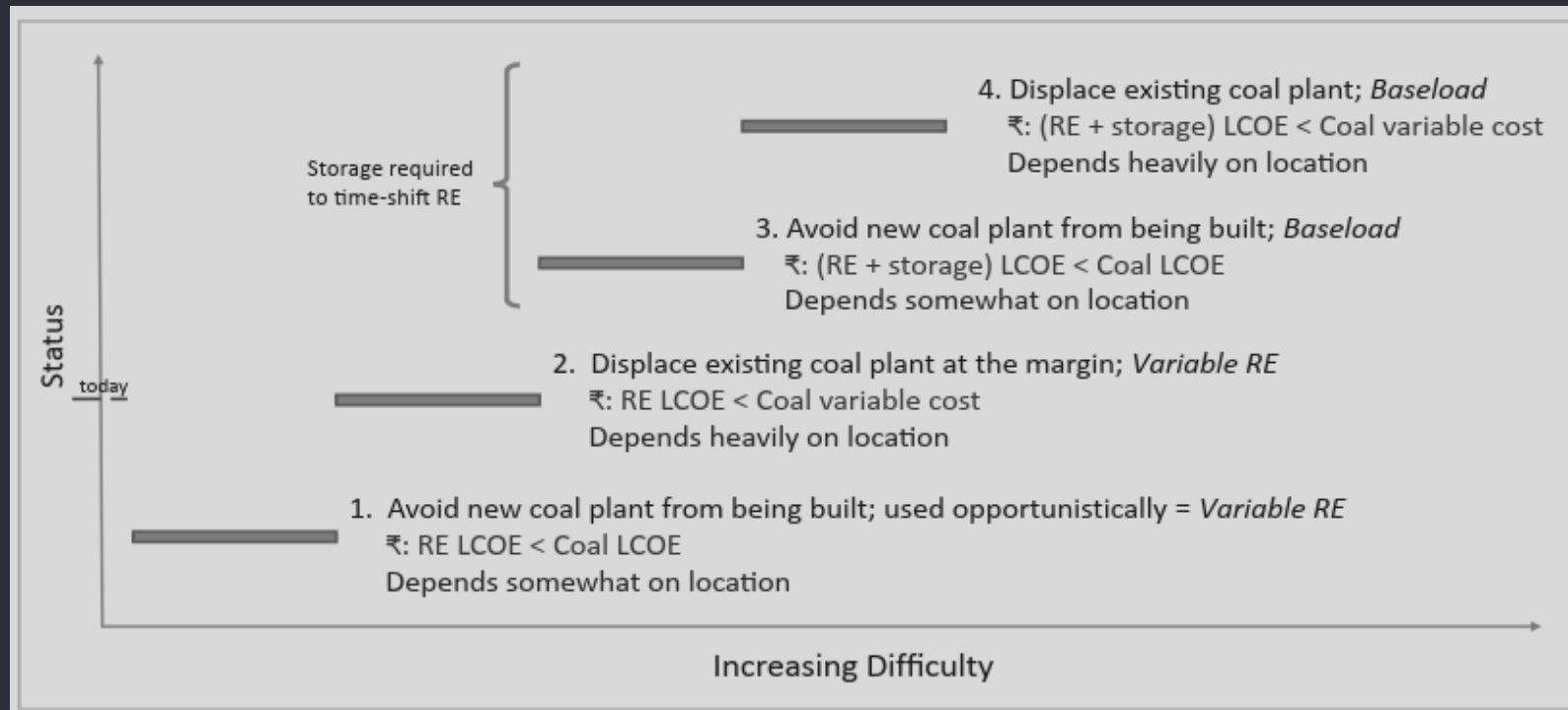
Generation is becoming more decarbonised, distributed and closer to the end consumer. This will become increasingly complex for networks to maintain the status quo without storage and smarter solutions



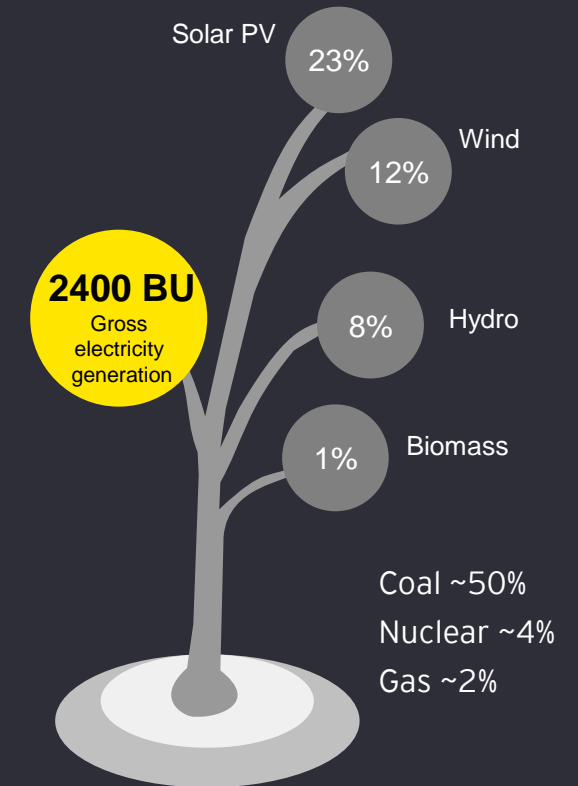
Deep decarbonisation - solar photovoltaics and wind power is expected to continue the trend of fastest growing sources for power generation in India



Renewable energy "vs" coal - ladder of competitiveness



Renewables generation mix by 2030



Source: Optimal Generation Mix for 2030, CEA 2019

Distributed energy sources - electric utilities (T&D) will be on the front line bracing the impact of decentralisation - three "tipping points" will emerge to have profound impact on future utility business models

Distributed generation

- ▶ Rooftop Solar PV
- ▶ Solar powered irrigation systems
- ▶ Small scale RE plants (micro grids) close to points of end user load (connected to 11kV or below distribution network)

Other distributed energy sources

- ▶ Demand response
- ▶ Energy efficiency
- ▶ Combined Heat & Power
- ▶ Smart EV charging / Vehicle to grid

Tipping point 1 (T1):

Birth of the new energy system

Where the cost of distributed solar generation plus storage reaches parity with the full retail price of grid-supplied electricity

Tipping point 2 (T2):

Electricity and mobility convergence

Where the price of battery electric vehicles (EVs) reaches cost and performance parity with internal combustion engine (ICE) vehicles

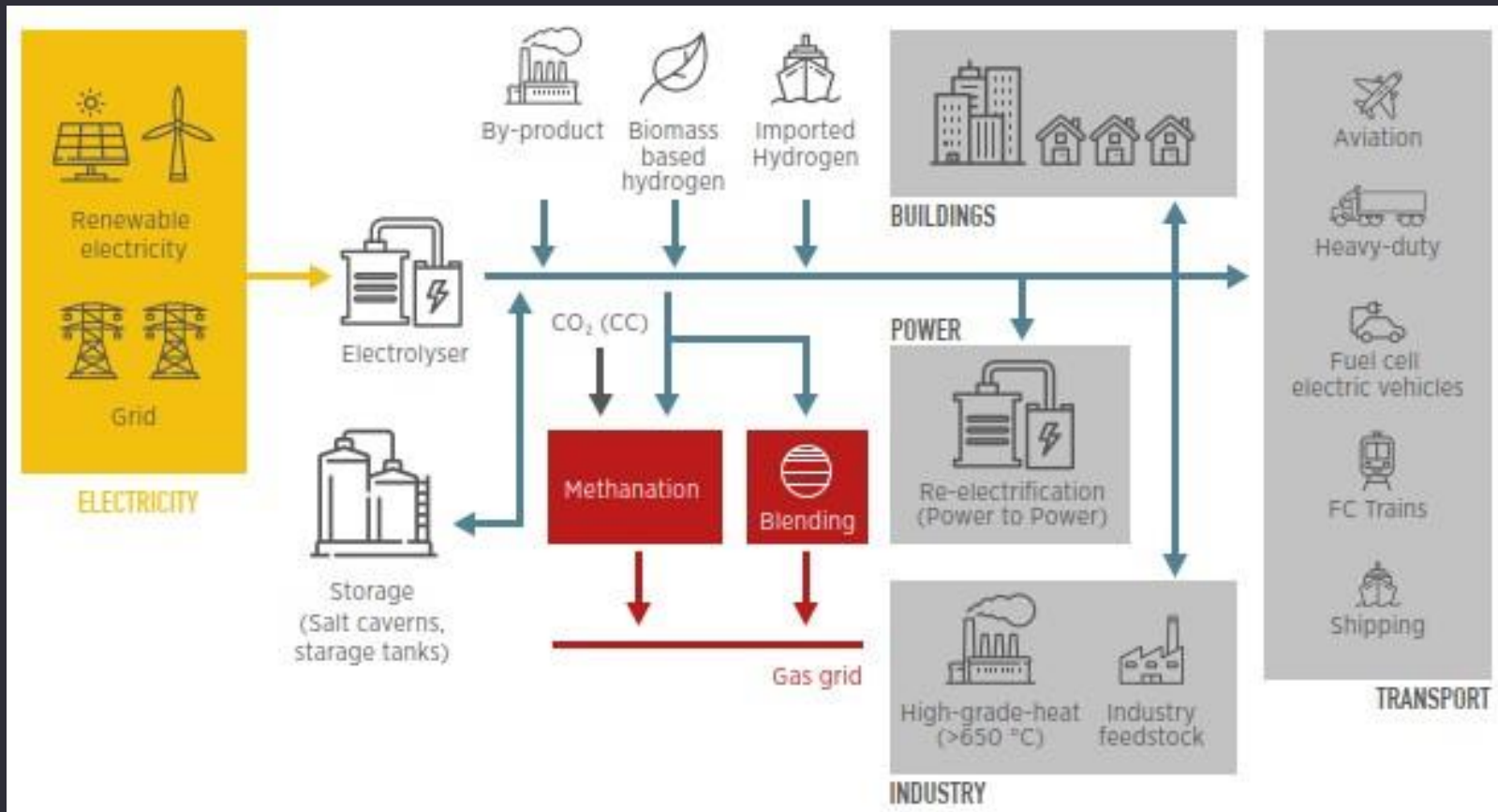
Tipping point 3 (T3):

Digital energy market place

The cost of transporting electricity exceeds the cost of generating and storing it locally

Understanding the when, what, and how of the tipping points creates opportunities and reduce exposure to financial vulnerabilities

Deeper electrification of heat (industry) and transport sectors (fossil to electricity) can boost the demand for electricity, reduce stress and also contribute towards clean energy transition



Electrification solutions available for industrial heat applications

- ▶ Electric furnaces
- ▶ Electric boilers
- ▶ Electric heat pumps

Current share of electricity in the final energy consumption ~17%
Expected share by 2050 ~50%

- ▶ The incremental in electricity demand resulting from deeper electrification can help integrate the increasing share of renewable energy in a cost effective way and minimise the exposure to various financial vulnerabilities across the power sector value chain

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