



**13th World Renewable Energy Technology Congress-2022**, Renewable Energy, Energy Efficiency & Sustainable Solutions for a Green Economy, 25<sup>th</sup> Aug 2022.

## **Energy Transition: 24x7 Solar Power for Sustainable Green Economy**

Dr. Shivani Sharma, Principal Technical Consultant, Power Consulting, Hitachi Energy, India.

- Dr. Shivani is a seasoned professional Engineer working extensively **>16 years in the Energy Industry & Smart Grids**, making outstanding Technical, Leadership contributions to **Energy Transition, R&D, Power system Analysis, EPC and Detailed Design Engineering** across geographies. Actively performing Power system studies / Design Engineering for various projects and **Grid integration, Policy Benchmarking & Grid Compliance of Large Renewables (Solar and Wind Farms); & DER's: E-mobility, Green Hydrogen, Microgrids**, as well as conventional Refineries, Chemical and Fertilizer Projects, Clean Fuel Projects, Power Plant (CCGP & Solar both), Electrical Arc Flash Analysis.
- Her **PhD** is in Electricity Regulations, Renewables, Data Mining, and **Master's** in Electrical Power Systems.
- Countries of Work Experience: **India, USA, Singapore, Germany, UK, UAE.**
- Work Organizations: **Hitachi Energy, ABB India Ltd., Samsung Engineering India Pvt Limited, and Reliance Industries Ltd.**
- Extensive Knowledge Sharing: Published/presented more than **45 research papers** in international and national journals /conferences, including international IEEE Keynote Speaker, IIT, NPTI, ISGF, GridTech, REI also received many Awards for best Technical Papers presented in the same.
- She is actively associated in the Core Committee of Professional Forums like
  - ✓ Patron, Advisory Board & Life Member, **Society of Power Engineers, Vadodara Chapter**
  - ✓ Executive Committee Member, **Society of Power Engineers, Delhi**
  - ✓ Executive Member of **Skills Council of India, NSDC, Delhi, India**
  - ✓ Registered Expert for **PhD Doctoral Progress Review Committee**, Gujarat Technical University
  - ✓ Technical Committee Core Member, Women in Power Chapter, **IEEMA, Delhi**
  - ✓ Membership in **CIGRE; IEEE Power & Energy Society** and Women in Engineering; **South Asia Women in Energy (SAWIE).**
- Consistently making contributions towards the Energy Sector, few recent acknowledgments as below please:
  - ✓ Special Appreciation for **"The Energy Woman of the Year (Renewable) Award"**, at **The Economic Times Energy Leadership Summit & Awards 2022**, New Delhi.
  - ✓ **"Engineering Excellence Award"** & special **"Citation"** for Contribution to Engineering and Power Sector by **Society of Power Engineers, Vadodara Chapter.**
  - ✓ **"Women Achiever in the Indian Industry"**, by **Industrial Automation Magazine.**
  - ✓ **"Engineering Leader of the year"** at Women Leadership Award by **Navi Mumbai Chamber of Business & Industries.**
  - ✓ Special Appreciation letter for providing Expert Training on **Renewable Integration** to Global participants of developing nations, organized by **National Power Training Institute (NPTI)** and sponsored by **Ministry of External Affairs, Government of India (GoI).**
  - ✓ Appreciation for **Unique Collaboration Category**, in Power Consulting Strategy Meet 2018, PGGI, ABB India Ltd.
  - ✓ Industry Expert for **@IndiaVision2047 Exercise**; Session Chair for **DIGIELEC BHARAT 2021** Conference on **Sustainability Theme**; Organizing Committee for Women in Power Chapter Launch; by **IEEMA (Indian Electrical and Electronics Manufacturers' Association).**



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“  
**Electricity  
will be the  
backbone  
of the  
entire  
energy  
system**

**01**

Accelerated shift from fossil-based to renewable power generation

**02**

Growing electrification of Transportation, Industry and Buildings sectors

**03**

Sustainable energy carriers, complementary to direct electrification

## Fast facts

- “ Electricity demand will more than double by 2050
- “ Electrification improves energy efficiency
- “ All market sectors converting towards electrification
- “ Energy sector-coupling beneficial

## So what?

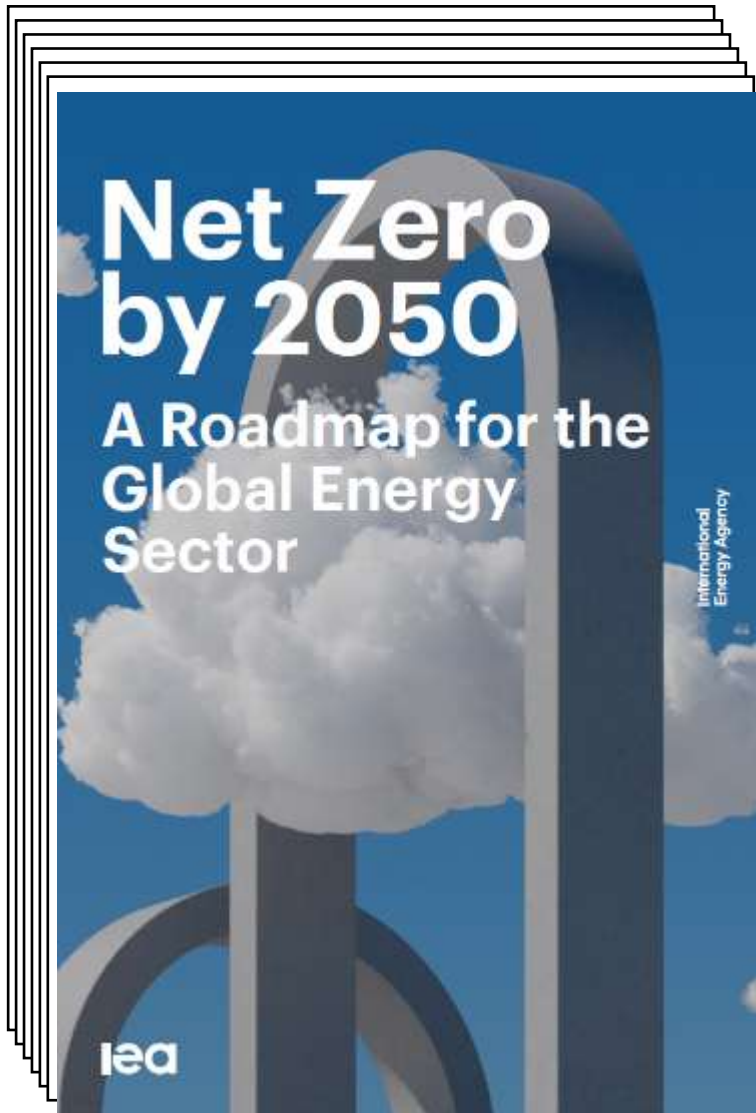
Digital and energy platforms are needed...

...to manage the enormous power system energy transition challenges:

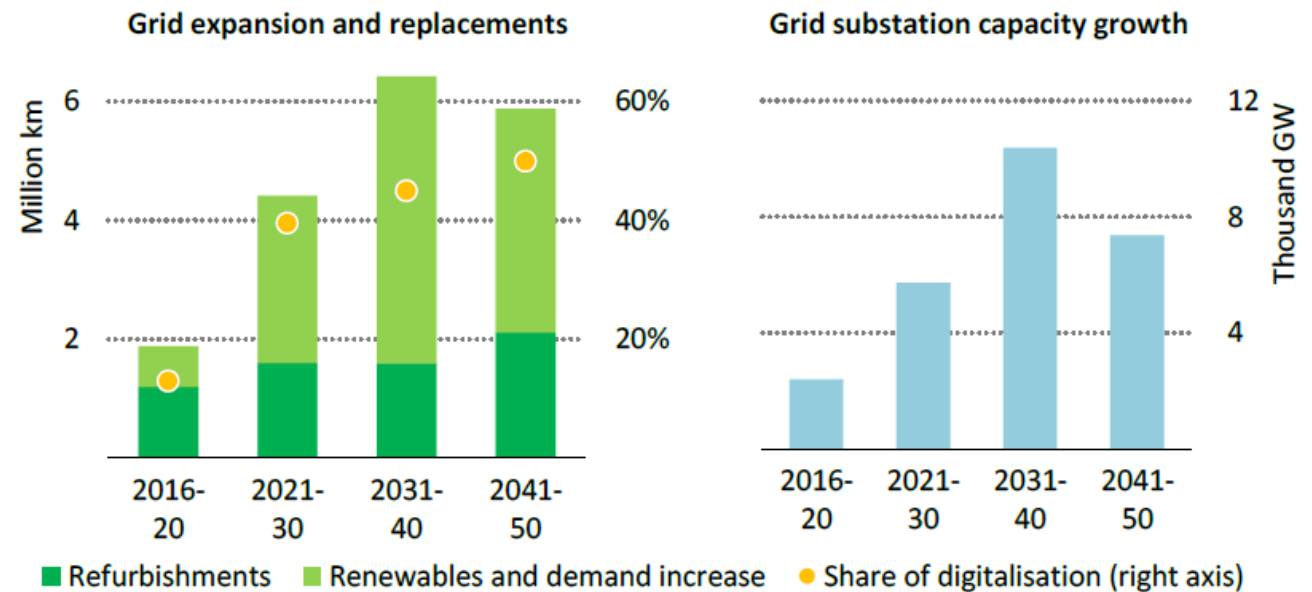
- increased complexity
- additional capacity

**for CO<sub>2</sub>e  
reduction**

**Powering good for a sustainable energy future, with pioneering and digital technologies, as the partner of choice for enabling a stronger, smarter and greener grid.**



**Figure 4.19** ▶ Annual average electricity grid expansion, replacement and substation capacity growth in the NZE

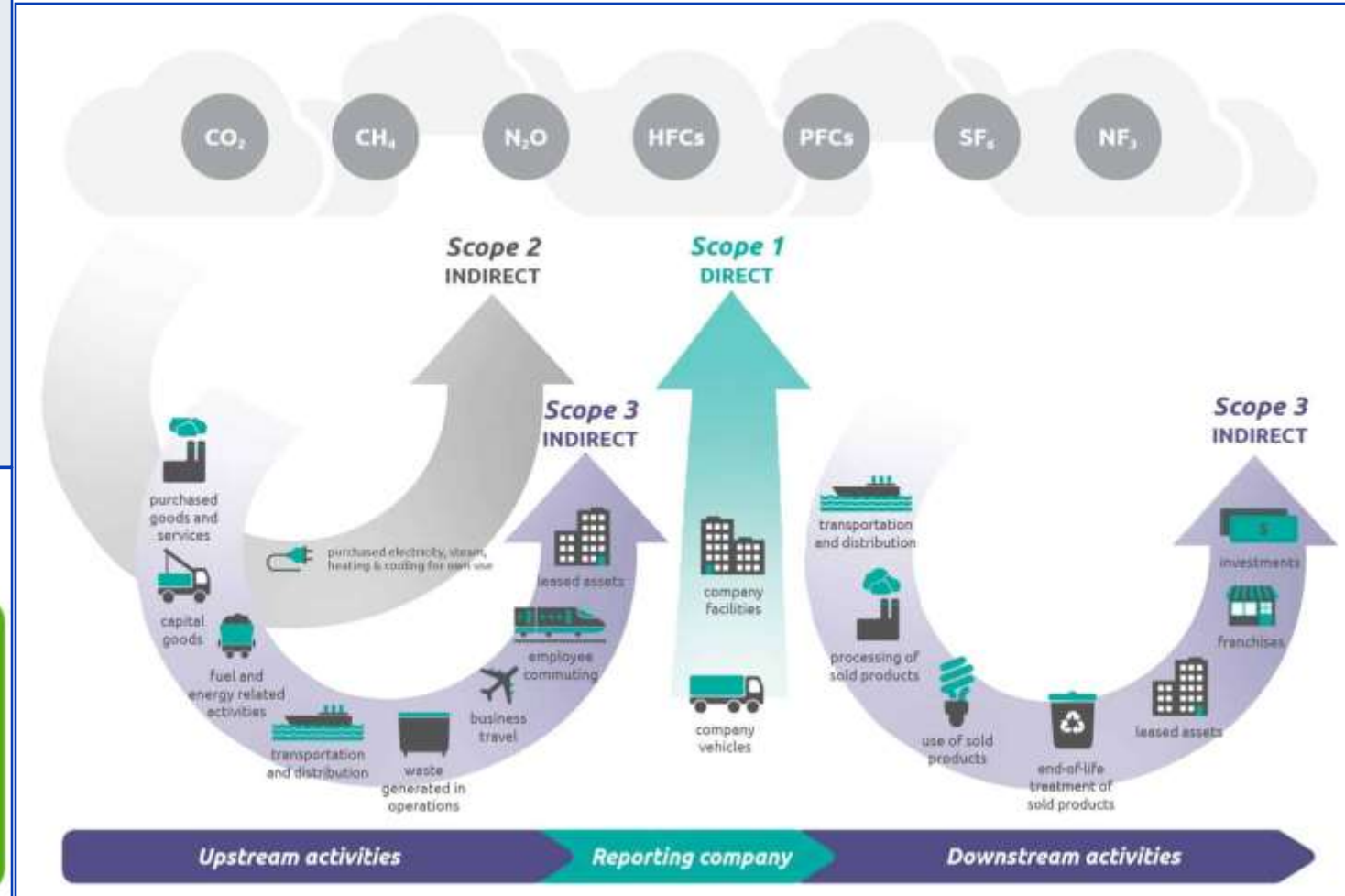
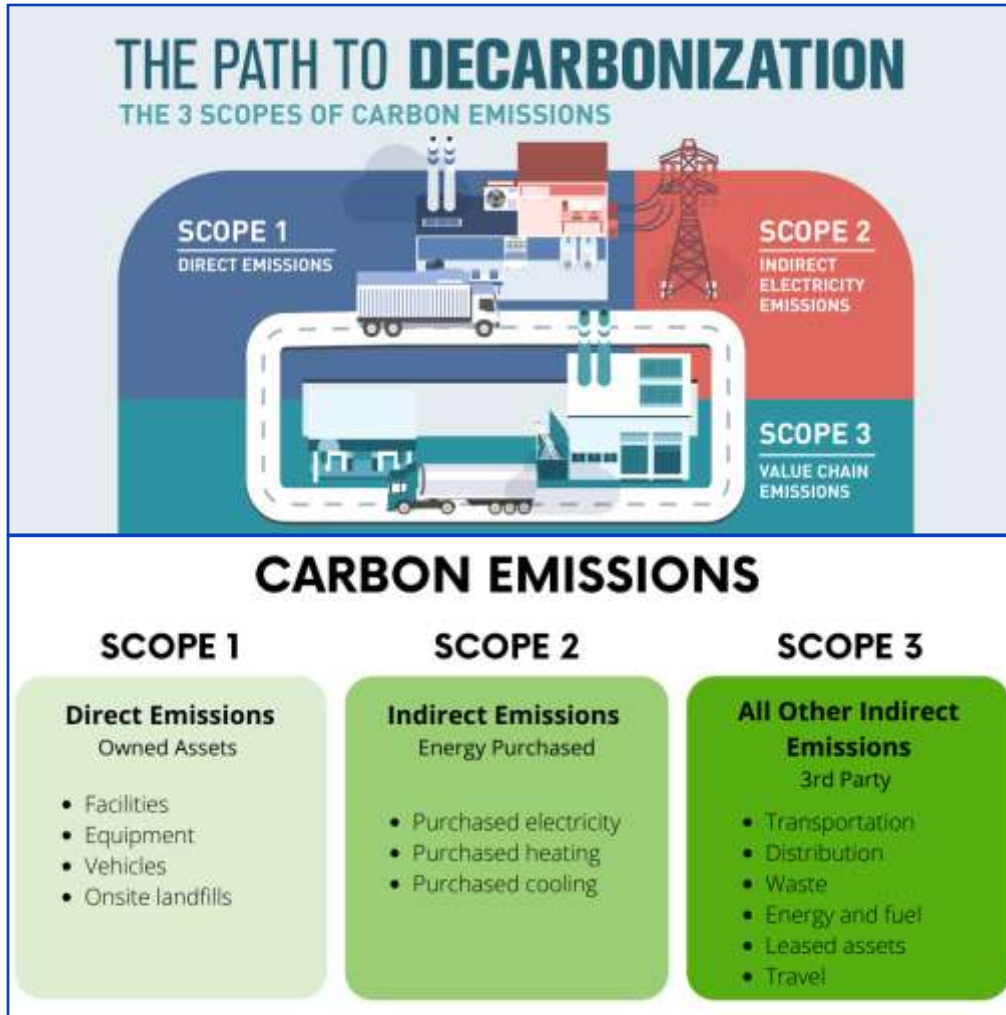


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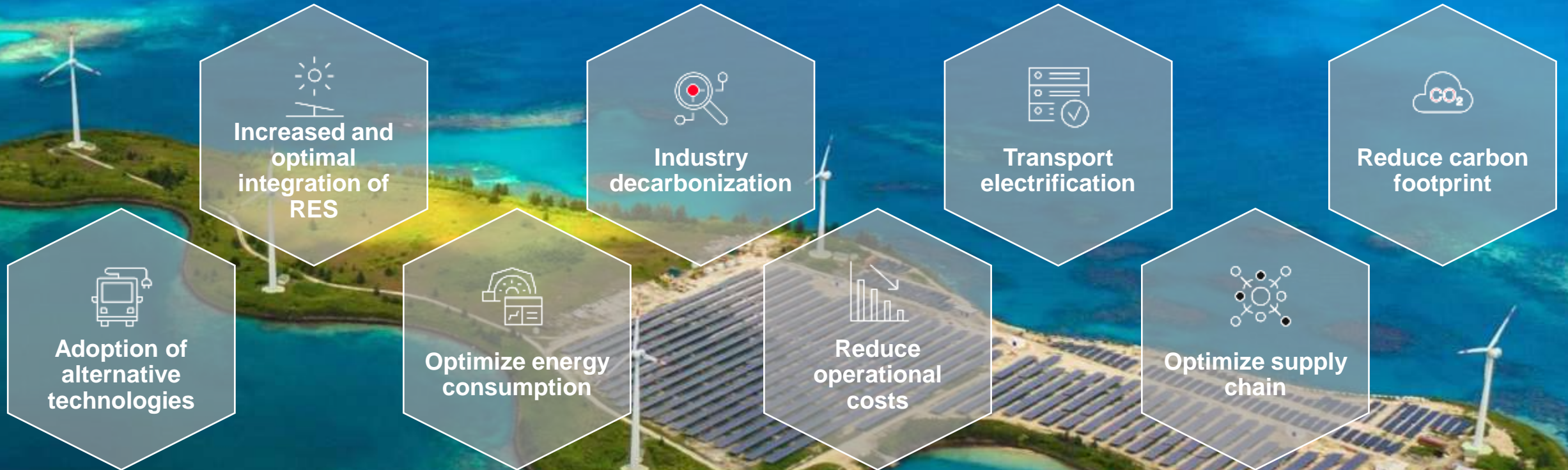
*Grid and substation expansion is driven largely by the massive deployment of renewables and electrification of end-uses, with a rising digital share of infrastructure*

Note: Substation capacity here assumes active electricity is equal to apparent electricity.





## Greenhouse Gas Protocol for Scope 1, 2 and 3 emissions



## Economic & Regulatory

- Technology developments, political & socio-economic factors
- Market policy & regulatory measures
- OPEX/CAPEX quantification
- Long term price and cost projections
- Strategic planning

## Grid Code & Interconnection

- T&D Analysis (planning and operation)
- Master plan definition
- E-mobility/DER/BESS/MG/RES impact
- Transmission type (AC/DC)
- Alignment with TSO/DSO expansion plans
- Grid code requirements risks at the specific countries of investment
- Grid impact from large intermittent energy sources
- Power Quality
- FEED

## Conceptual Design

- C&P Design & Evaluation
- Power Quality Assessment
- System design
- Plant sizing & connection point
- HV and collecting system design and optimization

## Operational

- LCA management
- Reliability and availability: FMEA and RCM
- Operational excellence – human resources - training
- Equipment performance & System Data Analysis
- AI Creation – algorithms
- Maintenance & Operations Improvement

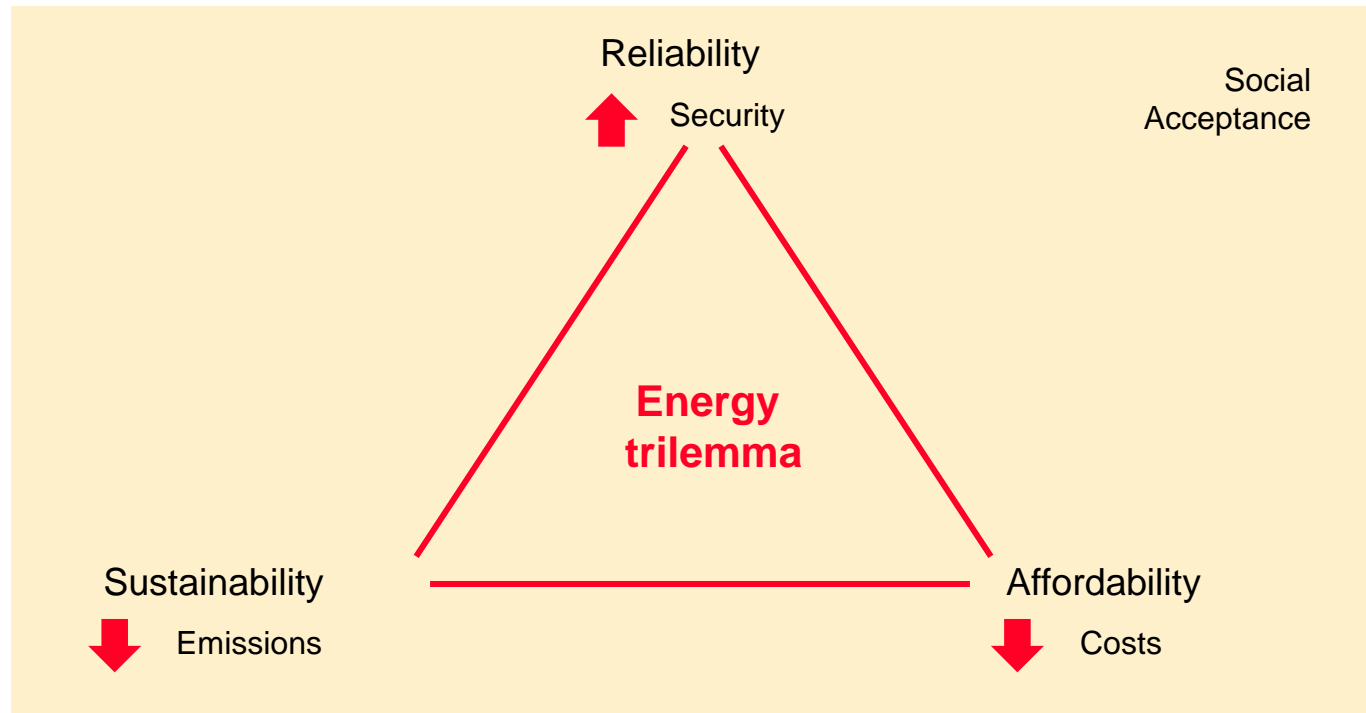
## Mitigation of risks and challenges



# Sustainability and Technology Transformation

– Solving the energy trilemma

Addressing **the energy trilemma for clean, secure and affordable energy impacts all the agents of the energy sector** (generators, final consumers, distribution and transmission companies, regulators, government, etc.) and in particular is and will continue to drive changes in our electricity energy systems globally for many decades to come.



**Dealing with the Energy Trilemma finding the optimal equilibrium through deep understanding of the energy sector**

## Comprehensive support throughout the entire project life cycle

### Strategic Plan Development



Assessment including technology developments, political and socio-economic factors



Review technical/operational procedures & boundaries



Market research on policy & regulatory measures relative to offshore plants



Profitability potential of offshore wind considering projections and costs



Cost benefit quantification OPEX/CAPEX optimization



Interconnection feasibility analysis (HVAC vs HVDC)



Grid impact analysis to understand the grid capacity, constraints and required upgrades



Training packages

### Roll out/Conceptual Design



Conceptual analysis, design and risk associated with grid connection



Align integration with TSO/DSO expansion plans – grid impact analysis



HV and collecting system design optimization



Grid code compliance assessment and compliance analysis



Technical advisory support for developer meetings with stake holders



Provide conceptual & basic design of electrical infrastructure



Power quality assessment and corrective measures



Training packages

### Operation and maintenance



Life Cycle Asset Management program development and management



LCA – Life Cycle Assessment of CO<sup>2</sup> footprint



Analysis of operational mode – best practices and assessment of alternatives (minimum losses, reactive power philosophy)



Protection system definition, philosophy, coordination and operation



Energizing process – risks, procedures and measures to mitigate insulation failure



Incident analysis – clarify technical reasons behind system or equipment failures



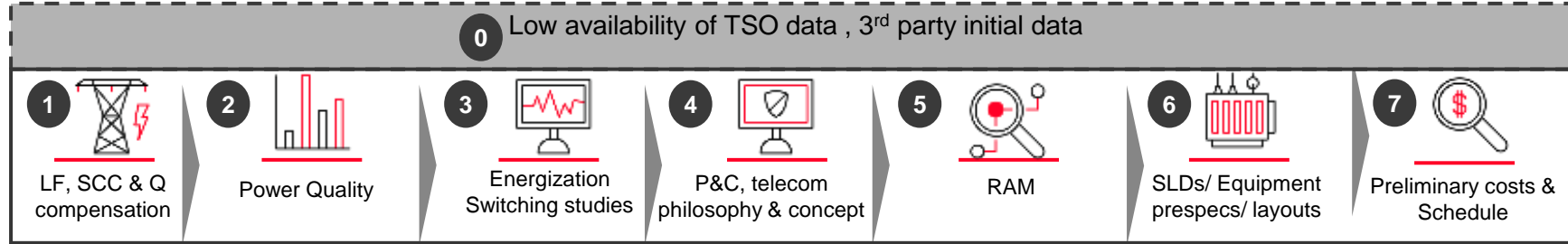
Reliability and availability: FMEA and RCM assessments to minimize outage impact



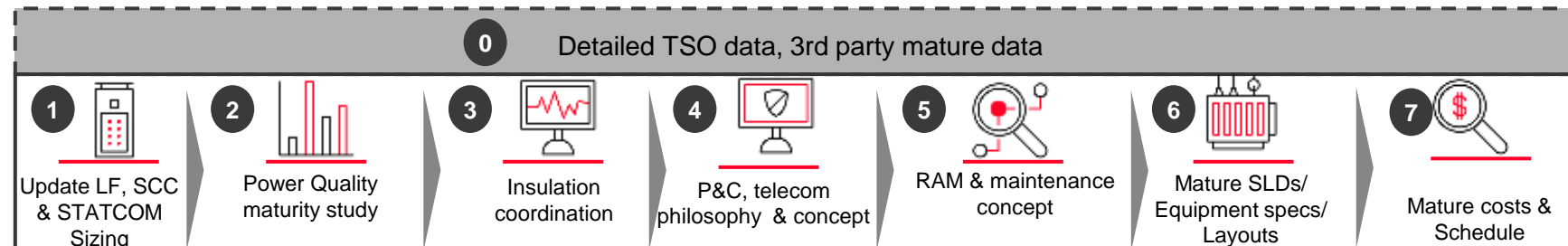
Training packages

**Ensure the optimal decision making at each project stage**

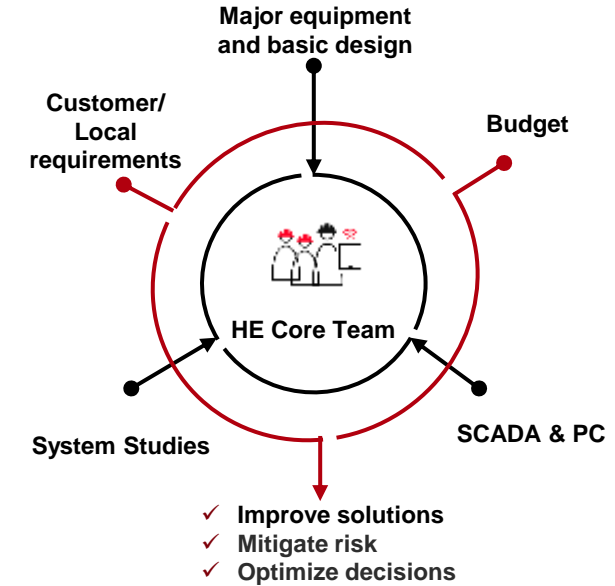
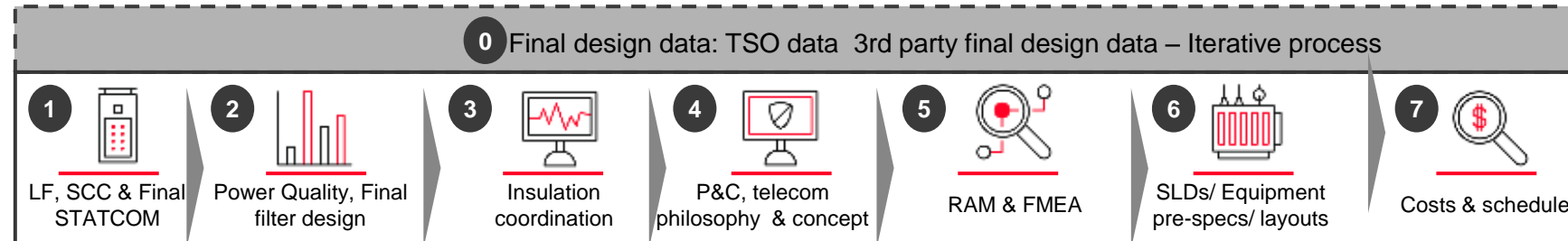
## Concept Stage – ESI\* System studies



## Pre-FEED/Concept Stage – ESI System studies



## FEED – ESI System studies



Maturing the solution

- Grid Integration of Large Renewables (Wind & Solar), also DER
- Sustainability Audits, Business Responsibility & Sustainability Reporting (BRSR)
- Systematic Sustainability Report and Strategic implementation
- Addressing sources of CO<sub>2</sub> emissions along the value chain;
- Sourcing fossil-free electricity in own operations;
- Reducing energy use in own factories/ Institutes;
- Maximizing energy efficiency in products / services.
- Skill Building
- Circular Economy



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Thanks for your attention



Q&A