What must be on your Opportunity Radar?

LENS on GREEN ENERGY

Thematic Opportunity Assessment Series (1)

April 2021

EVALUESERVE
POWERED BY MIND+MACHINE
20 YEARS

LENS on Green Energy

Background and scope of the report

At present, 70% of the energy consumed worldwide is catered through fossil fuels (oil, natural gas and coal), but growing investor and regulatory focus on sustainability has accelerated a transformation into low-carbon energy portfolios globally. Transition to renewable energy (referred as Green Energy in this report) is a strategic focus area for global businesses, providing an opportunity for long term value creation and climate risk mitigation.

This report covers the opportunity landscape for green energy. It focuses on identifying green energy technologies that will disrupt energy markets and drive a faster adoption of these new technologies. The report emphasizes our belief that emerging technologies will play a critical role in the adoption of renewable energy, scaling up supply and demand creation across newer sectors. It also highlights the risks associated with transition to green energy.

The report provides an executive summary and analysis of the green energy business landscape, participants and intends to inform business strategy. For a more comprehensive report on any component, a deeper dive is possible (on demand).

The Green Energy Revolution

What is driving the green energy revolution?

Investor Demand

RE Investments

Global renewable energy investments are expected to rise **by 8.5 %** to USD 255 bn in 2021 and the cumulative spend will likely reach USD 1.3 tn during 2021–25

Green Energy Bonds/ETFs

Alternative energy funds that primarily invest into solar, water, and wind energy witnessed an influx of **USD 5.2 bn** in the first two weeks of 2021, compared with an inflow of USD 17.1 bn in 2020

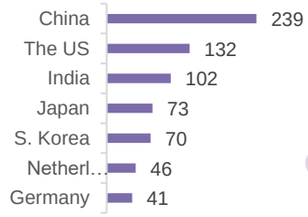
Global Institutional Investors

Allocation of Institutional funds is likely rise to 10.8%* of their total portfolio by 2030, up from 4.2% in 2020. The shift is expected to add **USD 742.5 bn** in green energy

Regulatory Hotspots

Energy Security

Green energy to get stronger regulatory support, as it provides an alternative to burgeoning crude oil import bills



Crude Oil Imports USD bn 2019

Energy-transition Reg

China and several other EU27 countries have submitted stronger NDC targets. China proposed to achieve net-zero emissions before 2060

Compliance Burden

Policies such as the EU Green Deal and Renewable Portfolio Standards (RPS) in the US are likely drive the adoption of green energy. Under the RPS, **14 US states** have pledged to have >50% clean energy in their energy mix by 2050

Competitive Intensity

Oil Majors have planned investments of USD 18 bn in wind and solar energy projects

TOTAL
eni.com
equinor

New Players

>1,500+ start-ups in the renewable tech space globally

Total funding USD 22.2 bn until 2019

Emerging Ecosystems

The green energy ecosystem is diversifying, with emergence of new technologies such as concentrator PV, Green Hydrogen

Bloomenergy
AIR PRODUCTS
BrightSource Limitless

Demand-side intensity

The number of corporate commitments to **net-zero tripled** during 2020

Business Impact

New Revenue Streams

Investments in hybrid renewables, storage, hydrogen fuel, distributed grid, EaaS, etc., are expected to unlock ancillary revenue streams worth **USD 16 bn** by 2030

Declining per unit cost of RE

The cost of renewables is falling rapidly for developers. In the US, the minimum LOCE of wind and PV has fallen to below **USD 30/MWh** and has become cost competitive to coal and gas

Rising Risks of Stranded Assets & Nations

The IEEFA estimates the value of stranded fossil fuel assets globally to be **USD 20 tn** over the next 30 years due to clean energy transition

Sources: IEEFA, Reuters, Climate Action Tracker, International Energy Agency, IRENA, UNFCCC, European Union, Lazard's, Tracxn, Wind Power Monthly, worldstopexports.com, NCSL, Oil Price, Transparencymarketresearch, IEEFA, *Octopus Renewables – Based on a survey on a survey of institutional investors representing $6.9 trillion under management.

EVALUESERVE 20 years

Overview of Green Energy Opportunity Clusters & Market Participants

What are the emerging opportunity clusters within the green energy value chain?

	Power generation and trading	Power transmission	Power distribution	Energy services (retail)	Electric devices and appliances
Emerging solutions	Distributed Energy Generation (Wind, Solar PV, Fuel Cell, etc.)	HVDC Transmission	Smart Grids, Energy Storage	Energy as a Service (EaaS), ESCOs	Energy Efficient Devices/ Appliances, Retrofits
Opportunity Size (Global)	**2019:** USD 242.6 bn **CAGR**: 11.5% (2019-27)	**2018:** USD 8.2 bn **CAGR**: 6.9% (2018-24)	**2018:** USD 37.69 bn **CAGR**: 21.8% (2018-23)	**2019:** USD 87.24 bn **CAGR**: ~11% (2019-24)	**2020**: USD 828.76 bn **CAGR**: 11.34% (2020-27)
Key Players	NEXTera ENERGY, IBERDROLA RENOVABLES, Brookfield Renewable Partners	ABB, GE, SIEMENS	ABB, GE, SIEMENS	Schneider Electric, ENGIE, SIEMENS	GE, PHILIPS, B/S/H/ BSH Hausgeräte Gruppe

The International Energy Agency study estimates that renewable energy generation will more than quadruple by 2040

End customers

Increased renewable energy generation has led to a strong surge in energy storage market

Sources: Grand View Research, MarketsandMarkets, MarketsandMarkets, MarketsandMarkets, MarketsandMarkets, IEA, Emergenresearch, Grand View Research

The Enablers: Emerging Green & Clean Energy Tech

Which technologies are transforming the current energy landscape?

Technology	Market Size (USD bn)	CAGR	Significant Activity & Select Deals	Key Players	Emerging Start-ups
Solar	2018: 52.5 2026: 223.3	20.5%	• Total SE is adding a 2 GW solar portfolio in Spain and has bought a 50% stake in a 2 GW portfolio in India • Adani Green Energy has secured a USD 6 bn (8GW) solar contract in India, which will be executed over the next five years	adani Renewables, Brookfield Renewable Partners, GCL New Energy, SB Energy, enel Green Power	OXFORD PV, RAPTOR MAPS, we power, sistine solar, BOXPOWER
Bioenergy	2019: 136.2 2024: 153.8	2.2%	• Australia launched a bioenergy roadmap, with an investment opportunity of USD 3.5–5 bn • Gevo has issued shares worth USD 350 mn to fund its capital projects	bp, POET, AMERESCO, Enerkem, LanzaTech	Manta Biofuel, BLUSHIFT, biofuel evolution, BIOD, Celtic Renewables
Hydrogen	2020: 130 2025: 201	9.2%	• Air Products plans to build a USD 5 bn green hydrogen plant in Saudi Arabia powered by 4 GW of renewables • Enegix Energy plans to build a USD 5.4 bn green hydrogen plant in Brazil	AIR PRODUCTS, Bloomenergy, PLUG POWER, fuelcell energy, BALLARD	ZEROAVIA, Enapter, hypoint, Power UP ENERGY TECHNOLOGIES, LOOP
Wind	2019: 93 2025: 151	8.4%	• BP has signed a USD 1.1 bn deal with Equinor to enter the offshore wind space • South Korea has signed a USD 43 bn agreement to build an offshore wind complex	IBERDROLA RENOVABLES, edp renováveis, NEXTera ENERGY, enel Green Power, BERKSHIRE HATHAWAY ENERGY	REVAYU Energy, ALTAEROS, MAKANI, PECOS WIND POWER, halo ENERGY
Energy Services	2019: 52 2024: 86.9	10.8%	• Siemens has acquired a 49% stake in Brasol SA and formed a JV with GIG to launch EaaS in the US • EDF Group invested in ECOSUN Innovations to strengthen its microgrid offer	Schneider Electric, VEOLIA, ENGIE, SIEMENS, Honeywell	BluWave-ai, sense, sparkfund, CANOPY POWER, watt is
Energy Storage	2020: 2.9 2025: 12.1	32.8%	• UK battery storage developer Penso Power plans to start 100 MW energy storage projects in 2021 • Total initiated a project to construct a 25 MW battery storage facility in France	FLUENCE, LG Chem, TESLA, NEXTera ENERGY, SAMSUNG, SAMSUNG SDI	Cadenza INNOVATION, Antora Energy, form energy, MALTA, moixa
Carbon Capture & Storage	2019: 1.75 2027: 6.13	19.2%	• Equinor, Shell, and Total have invested USD 750 mn in the Northern Lights CO2 storage project • United Airlines is investing millions in a carbon sequestration project	Shell, Linde, AkerSolutions, nrg, MITSUBISHI HEAVY INDUSTRIES	SOLIDIA, Global Thermostat, CARBON CURE, climeworks, Carbon Engineering

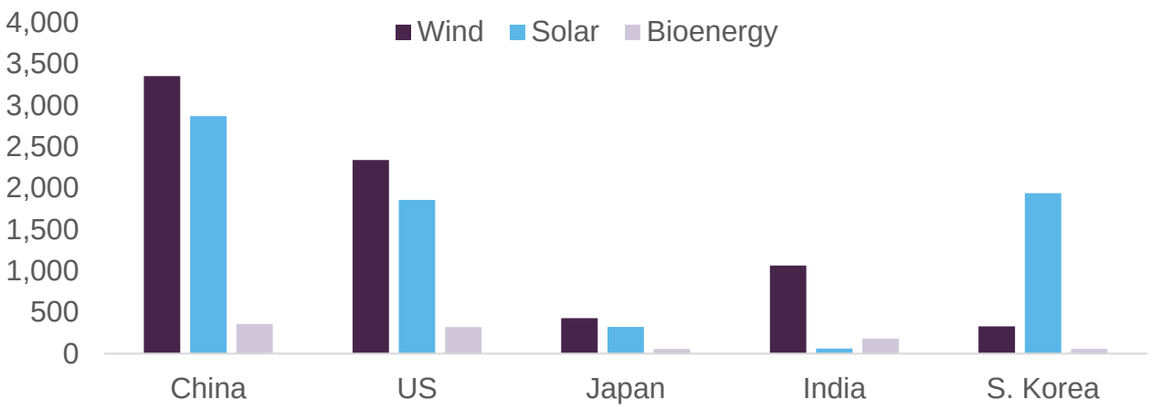
Sources: Solar (Allied Market Research; Deal 1; Deal 2; Players; Start-ups); Wind (Global Market Insights Inc.; Deal 1; Deal 2; Players; Start-ups); Hydrogen (MarketsandMarkets; Deal 1; Deal 2; Players; Start-ups); EaaS (MarketsandMarkets; Deal 1; Deal 2; Players; Start-ups); Bioenergy (Statista; Deal 1; Deal 2; Players; Start-ups); Energy storage (MarketsandMarkets; Deal 1; Deal 2; Players; Start-ups); Carbon Capture & Storage (Fortune Business Insights; Deal 1; Deal 2; Players; Start-ups)

The Facilitators: Deal Makers behind Green Technology Advancements

What alternative technologies are scaling-up supply and creating demand in newer sectors?

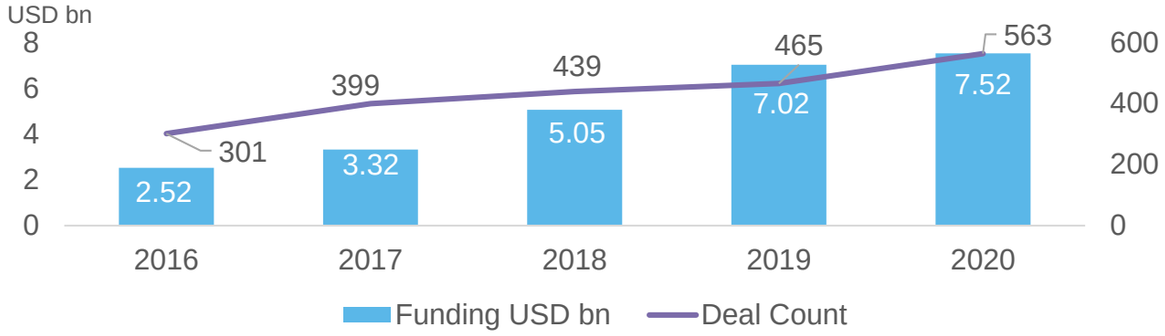
Alternative Green tech	Key players	Key highlights
Green Hydrogen	BALLARD, Bloomenergy, Air Liquide, SIEMENS, ITM POWER (Energy Storage | Clean Fuel)	• Declining wind and solar costs coupled with a decline in electrolyzer cost makes a good case for Green Hydrogen • In the transportation sector, hydrogen fuel can act as a direct replacement for gas and diesel as refueling takes only minutes, just like diesel and gas • The UK unveiled a USD 15 bn plan to use 4 GW of offshore wind energy for renewable hydrogen production
Floating Wind	Shell, ENGIE, equinor, TOTAL, edp renewables	• In Europe, floating offshore wind turbines can deliver an extra 4 TW over and above the continent's already leading level of bottom-fixed wind capacity • About 60% of the available offshore wind resources in the US are beyond the reach of existing fixed-bottom foundation turbines technology • Several oil and gas and electricity companies in Europe have shown strong interest in floating wind technology

Issuance of patents in the last three years by country*

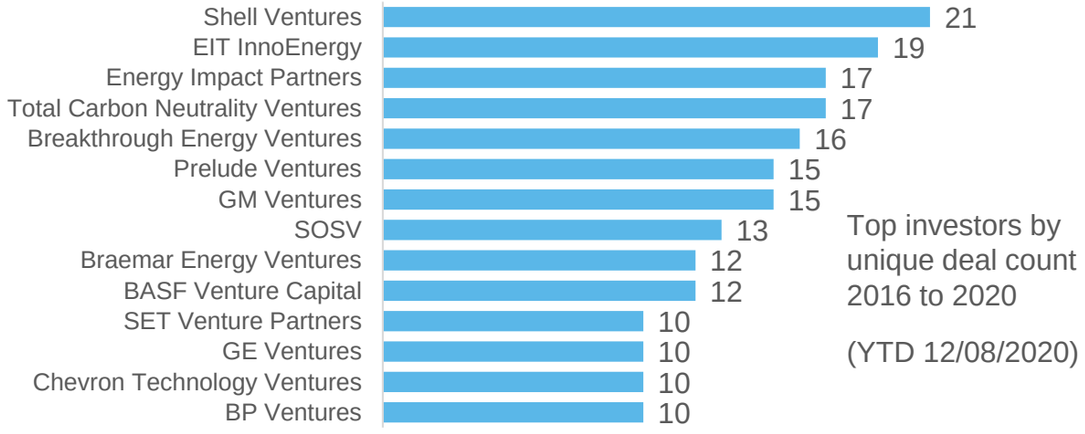


*Based on the patent issued to top six companies in Wind, Solar and Bio Energy. Source: Evalueserve subscribed patent databases

Renewable Energy Ecosystem Funding 2016-20E



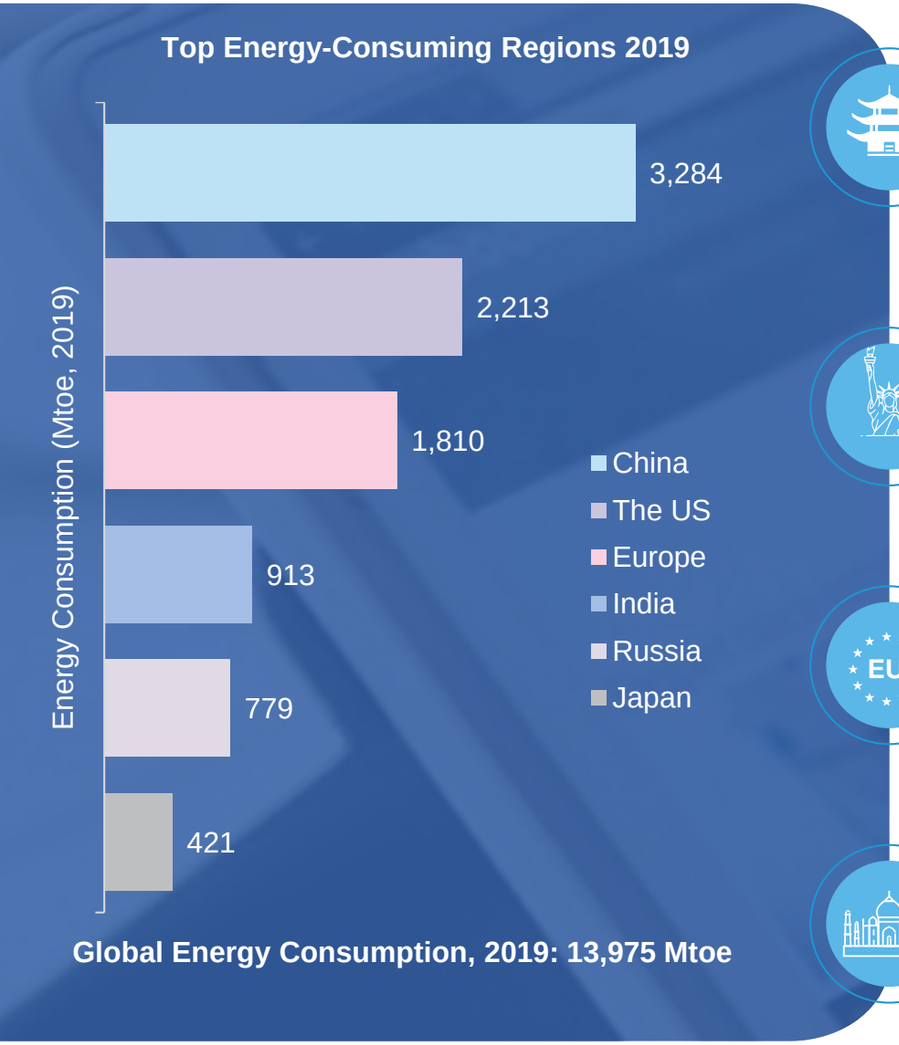
Source: CB Insights



Source: CB Insights

Top Consumers: Energy Security Remains a High Priority in Energy Policy

Is transition to green energy a solution to reducing energy imports and ramping-up energy security?



China

Most aggressive CO_2 reduction targets

- China has increased its 2030 CO2 reduction target to a minimum 65% of the 2005 emission levels, up from earlier target of within the 60–65% range
- Renewables are likely to account for 25% of the primary energy consumption by 2030, up from the earlier target of 20%
- The installed capacity for wind and solar is likely to reach 1,200 GW, up from the installed capacity of 415 GW in 2019

The US

Green energy gets stronger political will

- The Biden administration plans to make the US a 100% clean energy economy with net-zero emissions by 2050. Also, it plans to decarbonize the US power sector by 2035
- The US plans green investments of USD 2 tn over the next four years
- 13 states have already committed to the 100% clean energy target

The EU

Ahead of the game, focus on transportation sector

- After the COVID-19 pandemic, the EU plans to increase its 2030 emission reduction target to 55% (of 1990 levels) from the current 40%
- As per Reuters, to meet the new target, an additional EUR 350 bn of energy investments would be required between 2021 and 2030
- This has strong implications for the transportation sector, as the share of electricity, biofuels, and green hydrogen will have to increase to 24%, up from 8.88% in 2019

India

Green energy - a solution to deepening crisis

- India plans to generate 60% power through renewables by 2030
- The country imported crude oil worth USD 102 bn in 2019, and volatility in crude oil price is a perpetual threat to the country's economy
- India will need new investments of USD 500–700 bn by 2030 in the renewable energy sector, according to the Institute for Energy Economics and Financial Analysis (IEEFA)

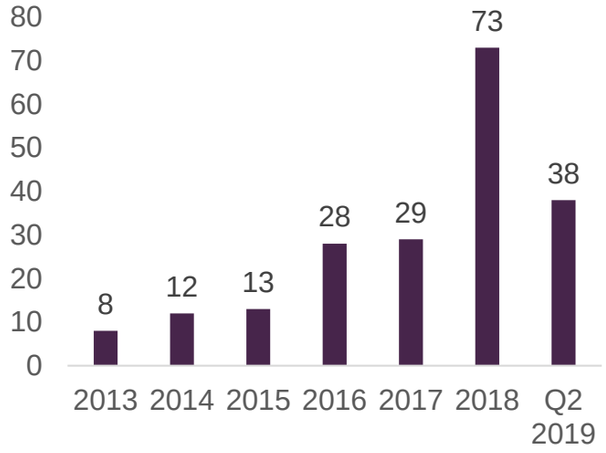
Sources: S&P Global; GreenTecMedia EU 2030; GreenTechMedia Clean Energy Target; Carbon Brief; Business Standard; Economic Times; FARM EUROPE

And Investors: Powerful Vehicles that Mobilize Capital & Mainstream Green Energy

ESG investing is in focus; will this also drive institutional investors towards green energy?

Institutional Investors are increasingly betting on Green energy

Number of renewable energy project transactions involving institutional investors 2013-Q2 2019



Source: IRENA analysis. Data includes Solar, Wind, Hydropower, Mixed Renewable, Bioenergy, Geothermal

Sovereign Wealth Funds (SWFs) & Pension funds

Japan Pension Investment Fund
Total fund size: USD 1.6 tn
In Dec 2020, Japan's GPIF allocated roughly **USD 9.7 bn** to a general ESG-themed index from MSCI

Norway Govt. Pension Fund
Total fund size: USD 1.1 tn
Planning to invest **USD 10.83 bn** between 2020 and 2022 in unlisted renewable projects

ABP Netherlands
Total fund size: USD 515 bn
Aims to invest **USD 5 bn** in green energy companies during 2020-25

Canadian Pension Plan
Total fund size: USD 475.7 bn
As of Sept 2020, the fund invested **USD 6.75 bn** in green energy equity

Saudi Arabia Public Investment Fund
Total fund size: USD 400 bn
In 2018, Saudi Arabia's PIF planned to invest **USD 45 bn** in SoftBank for Solar Projects, until 2030

PFZW Netherlands
Total fund size: USD 310 bn
Plans to reduce the carbon footprint of its listed equity portfolio by **30%** in 2025

Private asset managers green funds

Blackrock, Inc.
Total AUM: USD 8.7 tn
As of April 2020, BlackRock held over **USD 45 bn** in 105 sustainable ETFs and index mutual funds

UBS Asset Management
Total AUM: USD 1.1 tn
UBS AM offers 19 ESG ETFs and witnessed it sustainable ETFs cross **USD 11.8 bn mark** in 2020

Robeco Global
Total AUM: USD 215 bn
RobecoSAM is the ESG focused investment division of S&P Global and holds client AUM, advice and/or licenses of ~**USD 24.3 bn** as of June 2019

Hurdles

- Difficulty in finding suitable unlisted renewable-energy projects
- Too much capital chasing few targets leading to strong competition for stakes
- Unpredictable and fragmented policy support
- Nascent and illiquid green bond market
- Cost of carbon footprint calculation, fossil fuel subsidies
- Uncertainty of risk-return profile and green portfolio performance

Sources: Reuters, IRENA, Japan – Link1, Link 2; Norway; Netherlands; Canada – Link 1, Link 2; Saudi Arabia – Link 1, Link 2; Wind Power Engineering; BlackRock – Link 1, Link 2; Pictet – Link 1; Link 2; Robeco – Link 1, Link 2; UBS – Link 1, Link 2; PFZW Netherlands – Link 1, Link 2

Risk Landscape: Bottlenecks to Green Energy Vision

What are the potential risks and challenges to the adoption of green energy?

High ● Medium ◒ Low ◔

	Overall Risk*	Solar Bio. H2 Wind ES CCS	Risk Outlook & Hurdles
Capital / Financial	High	● ● ◒ ◒ ◒ ●	**Major Risk Factors**: Credit risk, long return period, and cost overruns Factors such as lack of credit information, fast-changing regulations, and a higher risk of technological obsolescence may lead to mispricing of risks and poor capital allocation to clean energy
Regulatory / Environmental	Medium	● ● ◒ ◒ ◒ ◔	**Major Risk Factors:** Absence of pricing / tariff mechanisms, uncertainty of tax incentives, land availability, and social opposition Top energy-consuming countries have substantially increased their clean energy targets post the pandemic. However, implementation will require structured policy interventions across the value chain (grid, pricing / tariff, land availability, etc.); slow reforms in these areas will be a big risk
Operational risks	Medium	◒ ◔ ◒ ● ◔ ◔	**Major Risk Factors**: Frequent breakdowns, unpredictability of weather, and utilization rate Frequent equipment breakdown and the impact of climatic conditions on operations pose major risks for fast-growing renewable technologies such as solar and wind. The use of low-cost / quality components further aggravates this risk. The recent Texas blackout alone caused USD 16 bn in overcharges for Utilities and Energy Services companies
Supply chain (materials / labor)	Medium	● ◔ ◒ ◒ ● ◒	**Major Risk Factors**: Supply chain disruptions, lack of skilled labor, market access Renewable technologies, such as Battery storage and Solar, are dependent on imports of rare earth metals. China, a key supplier of such metals, recently introduced the export control law (ECL) to control the export of strategic commodities. Such events will pose challenges in the future, with rising protectionism and geopolitical tensions

To Watch Out For

- Countries such as the US and Germany are planning to eliminate wind and solar subsidies, which may slow down investment growth. In 2020, US senators proposed the PTC Elimination Act, which would remove subsidies to developers

To Watch Out For

- With an increase in the number of installations, cyber security is becoming a major concern across the renewables value chain. Many existing systems were built prioritizing efficiency over security and can be exploited by malicious actors

Sources: Economist Intelligence Unit, SwissRe, International Energy Agency, GreenRhinoEnergy, Greentransition.org, NortonRoseFulbright (Hydrogen, Energy Storage), Energypedia, Responsible Investor, Risk and Insurance, S&P Global, Global CCS Institute, Greentechmedia, Accenture

*Evalueserve Experts assessment and analysis. Bio. – Bioenergy; H2 – Hydrogen; ES – Energy Storage; CCS – Carbon Capture & Storage

The Way Forward

What are implications and opportunities for PS firms in the green energy transition space?

Near term-outlook based on emerging trends, evidence and implications

Our analysis suggests a high near-term confidence for renewable energy (RE) growth over the next three years and a strong appetite for **energy storage** and new technologies like **green hydrogen and floating wind**, albeit at a staggered pace globally.

Some trends and their implications are noted as under:

- **Emergence of sustainable energy ecosystems**: Decarbonization, deregulation, and decentralization of the sector is leading to the emergence of new collaborative ecosystems and partnerships. “Sustainability in Energy” is leading businesses to co-develop energy management strategies and utilize new technologies. RE ecosystems will span across new sources of generation, transmission, storage, distribution grids and enabling hardware devices and software. This is likely to transform business models from ‘Energy-as-a-cost’ model to ‘Energy-as-a-Service’ outsourced contract. As evidence:
  - Increasing shift to high value PPAs* for RE among the RE100 firms (e.g., Apple, Google, Starbucks, Exxon, Walmart, Budweiser)
- **Transition to green energy will be capital-intensive in the short term:** Efficiency and savings in the long term will ride on back of sizeable investments the short term. As example, according to a June 2020 report from IRENA**, replacing the costliest 500 GW of coal with solar PV and wind would cut power system costs by up to USD 23 bn every year and reduce annual emissions by around 1.8 Gt of CO2. It would also yield an investment stimulus of USD 940 bn, which is equal to ~1% of the global GDP.
- **Transition finance, insurance and structured risk planning is critical:** Despite abundant capital chasing green energy, a financing gap exists at two levels: 1) finance for low-risk small-ticket projects in the early stages of innovative clean energy technologies; 2) transition support finance, backed by guarantee. Insurers have an important role to play by hedging inherent project risks, thus creating an easy path for sustainable green energy finance and rationalizing the cost of funds. The recent failure of the Texas power grid in the US due to a significant dip in temperature that froze natural gas supply lines and jammed wind turbines reinforces the fact that careful forward planning of transition to RE is essential as more green energy joins the grids. Long termism is critical for risk planning, implementing and assessing ROE on green projects.
- **Stranded assets & stranded nations**: Conventional assets will increasingly become stranded during the energy transition, due to premature write-downs and devaluation, which will affect the US, the EU, and China the most. Large corporates that have fossil-fuel dependent business models will need stronger policy and regulatory support to switch and price risks from stranded assets. Also, investments in technologies such as Carbon Capture and Storage can prove to be a lifeline for fossil-fuel backed business models.

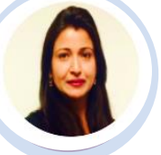
Opportunities for PS firms (Renewable Energy Consulting)

- Carbon footprint & decarbonization
- Opportunity assessments & scoring
- Market entry, expansion, M&A
- Green energy procurement & aggregation across partner ecosystem
- Green energy implementation, transition and strategy support
- Audit, compliance and certification
- Energy Efficiency services consulting - procurement, distribution and monitoring
- Green Energy Finance, Bond issuance and Project Insurance

Sources: IRENA; Consultancy.in; Wavestone; Wood Mackenzie; Cleanenergy; Universidade NOVA de Lisboa; Forbes - Energy Ecosystem; Forbes – Renewable Investment; Indiatimes; IRENA – Stranded Assets; *RE –Renewable Energy (Green Energy); **The International Renewable Energy Agency

Evalueserve Team

Authors



Sangeeta Upadhyay, Associate Vice President

- Sangeeta has over 16+ years of experience in investment research and consulting. As a Professional Services solutions architect , her domain focus is Corporate Finance, Business Strategy and Sustainability. She holds a Masters degree in Finance and an undergraduate degree in Engineering.

Anne-Solène d'Orchimont, Associate Vice President

- Anne-Solène has 14+ years of experience in providing research support, governance and leadership to strategic management consulting firms across global delivery teams. She holds an MBA degree in Finance and Management.

Vipul Mendiratta, Associate Vice President

- Vipul has 15+ years of IP experience in strategic patent research support, patent portfolio building, IP licensing and patent-based M&A consulting. His domain focus is the Mechanical & Automobiles. He holds an US Masters degree in Law, JD from India and undergraduate degree in Engineering.

Abhishek Dwivedi, Senior Research Lead

- Abhishek has about 12 years of experience in providing secondary research and thought leadership support to management consulting firms. His domain focus is on oil & gas and renewable energy. He has an MBA degree in Oil & Gas management.

Nishant Nair, Senior Business Analyst

- Nishant has 4+ years of experience in providing research support to management consulting firms and writing syndicated research reports. His domain focus is on oil & gas and power. He has an MBA degree in Energy Trading.

Thank you for your interest in Evalueserve Thematic Assessment Series (1)

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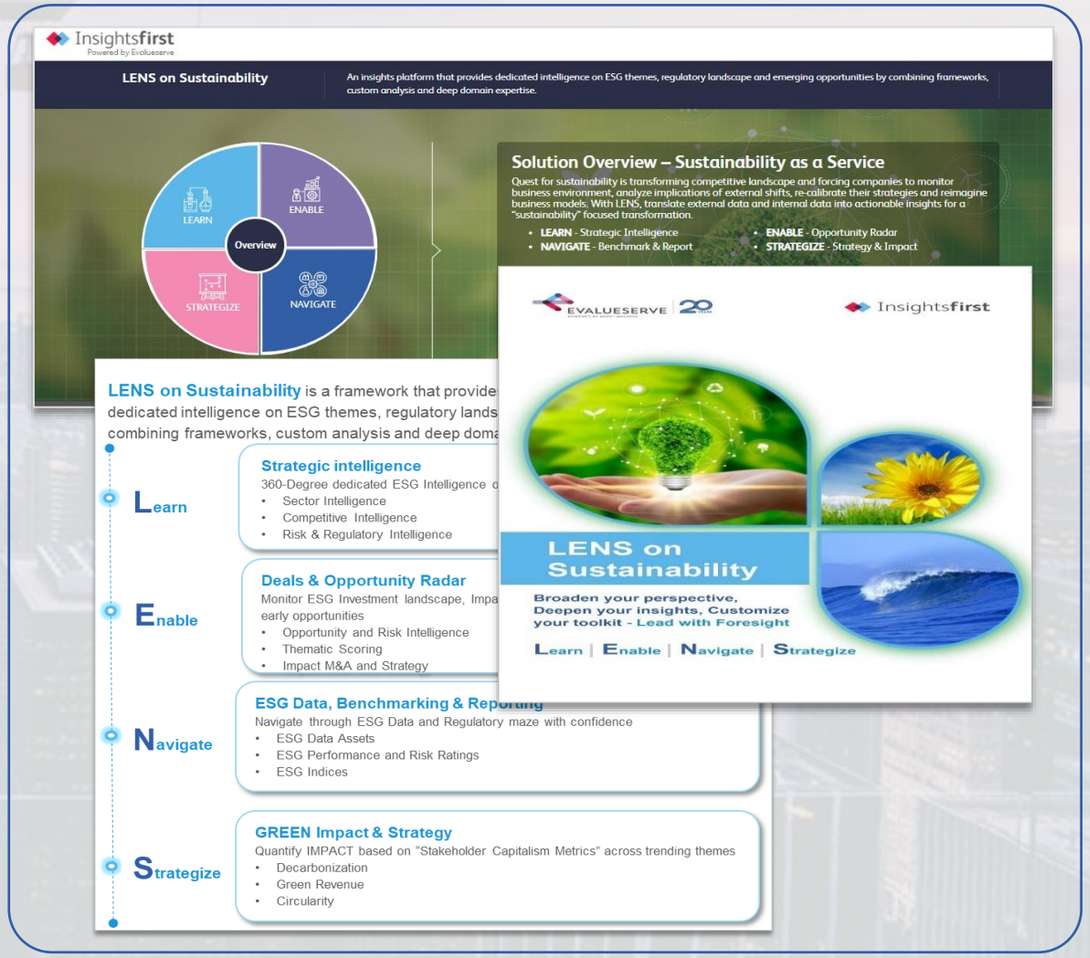

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