TOP 10 IDEAS

INVESTING FOR IMPACT

Renewable Energy & CleanTech

— Impact Future Project —

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ASPIRE IMPACT

Aspire Impact is a social enterprise focused on leadership and ecosystem development in social and environmental impact. Aspire Impact is India's first Impact Rating system, awarding Green Leaf, Silver Leaf, Gold Leaf or Platinum Leaf to corporations using a proprietary 4P (Product, People, Planet & Policy) framework. It is also the Commissioner of the Impact Future Project (IFP).

ASPIRE CIRCLE

Aspire Circle promotes enlightened social leadership. It builds and scales Fellowships, Scholarships and Internships, to catalyse India's Impact leadership capabilities. Since inception in 2007, Aspire Circle has engaged 200 Fellows and awarded 33 scholarships. It is also the Secretariat of the Impact Future Project, engaging business and investment leaders for the imminent impact economy.

IMPACT FUTURE PROJECT (IFP)

The Impact Future Project (IFP) is a thought-leadership platform and an appreciative enquiry about the imminent Impact Economy. IFP will generate bold, transformative investment ideas for 2030 with 200+ business and investment leaders, in sectoral communities of 20-30 each, to create new research, knowledge, awareness and advocacy for an era of impact measurement & reporting.

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Impact Future Project

TOP 10 IDEAS

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Renewable Energy & CleanTech

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Founder's Preface

Visionary voices for a century, from Mahatma Gandhi to recent Nobel Laureates such as Muhammad Yunus and Al Gore unequivocally support the idea of a sustainable Impact Economy. The world's social and sustainability challenges have accelerated protests over the last decade, from Occupy Wall Street to Extinction Rebellion. Impact Economies provide a solution to address these challenges and achieve the UN's Sustainable Development Goals (SDGs), as we embed Impact, alongside Risk and Return, in every business, investment, policy & consumption decision. The imminent Impact Economy requires us to envision the future, so that India may chart her path with confidence.

The Impact Movement, which has grown globally to $59 trillion, as per GSIA, is an unstoppable trend. We estimate that India has attracted only ~1% of this global capital pool. India Inc. must enhance its embrace of the Impact movement. The environment cost alone of India's 35 large companies at $200 billion, is three times their net profit, rendering them uncompetitive in this new era of Impact Capitalism. The root cause is a lack of corporate alignment with impact, as there is no mandatory Impact Reporting. The recent Government decision to increase mandated Business Responsibility & Sustainability Reporting (BRSR) from the top 500 to the top 1000 companies is a welcome step, but just not enough. We need distinct ESG (Responsibility), Sustainability & Impact standards and strategies.

Aspire's Impact Future Project (IFP) set up in 2020, ten Impact Communities of ~20 leaders each, with representatives of different stakeholder groups. These IFP groups have held quarterly conversations to spark an appreciative enquiry about our shared Impact Future. IFP seeks to grow the knowledge & research, awareness & advocacy, education & training for the Impact Movement.

We are proud to release the eighth of our ten research reports, on "Renewable Energy & CleanTech". Our research highlight the Top 10 emerging investment themes in the sector-Green Bonds, Consumer centric CleanTech, Electric Mobility, Utility Scale Solar, Micro Grids, Energy as a Service, Peer to peer (P2P) energy trading, Green Hydrogen, Green Gas Grid and Carbon Recycling - can collectively attract $266 billion investment by 2030, up from $61 billion in 2020 and create revenues of $146 billion, up from $24 billion in 2020. This is the promise of Impact in Renewable Energy & CleanTech.

I thank all our Impact Leaders, our Co-Chairs, our Knowledge Partners, our Industry Partners, our Event/Convening Partners and Capgemini, our sponsor, for their support. I hope this comprehensive research across 10 sectors and 1000 start-ups is compelling for your own Impact journey.

Amit Bhatia
Founder & CEO- Aspire Circle & Aspire Impact

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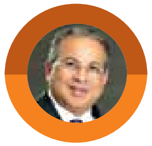
Chair



Dear Readers,

India's pledge to reach Net Zero emissions by 2070 at COP27 in Glasgow is a clarion call to all of us to turbocharge our impact initiatives, especially those of us in the energy sector. We, at Tata Power, have already committed to reach Net Zero before 2050. In fact, given the rapid success of the ESG movement and equally rapid growth of the Impact movement, we must all focus beyond just our emissions to our overall, comprehensive social and environmental impact.

In this context, I am honored to chair Aspire Circle's Impact Future Project (IFP) community on Renewable Energy & CleanTech. Launched over a year back in late 2020, the project's mission is to list a carefully researched menu of impact investment opportunities in the energy sector, enabling actors to launch their Net Zero journey and maximise impact. Our Top 10 ideas are listed in this IFP "Investing for Impact" series. We have also estimated the potential for investment, revenue, impact on lives , and creation of jobs across these ideas.

I believe the 21st century calls on all of us to change our DNA for an era of Impact Capitalism. This will entail embracing new investment opportunities while shedding our fossil-fuel footprint. These top 10 impact investment ideas are a great template to start thinking about this future.

I thank all our community leaders for making time available for this venture; PriceWaterHouseCoopers, for their knowledge partnership; CLEAN Network, for their industry support; Capgemini, for their sponsorship; and, of course, Aspire Circle, for their leadership and foresight. I am confident that this thematic impact research will add to the body of knowledge on our imminent Impact Economy.

Dr. Praveer Sinha
CEO & MD
Tata Power

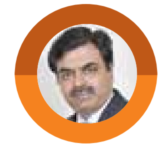
Sponsor

Dear Readers,

Capgemini is delighted to support and sponsor the Impact Future Project (IFP). We believe the time has come when the idea of an "Impact Economy" must be mainstreamed. The pandemic has reminded us on the sustainable balance we must maintain with the planet and amongst the people. This will only be possible when all organisations, for-profits and non-profits, corporations and funds, transparently measure and report their impact. We believe the IFP is a significant thought leadership initiative in helping build this awareness and a greater imperative to act. IFP not just resonates our values and pursuits of a purposeful existence, but takes us a step forward towards this envisioned impact future.

Anurag Pratap
Vice President, Digital Inclusion & Sustainability Leader, Capgemini

Knowledge Partner



Dear Readers,

PwC is delighted to partner with Aspire Impact and anchor the discussions on Renewable Energy, Clean-Tech & Climate Change Infra Impact Community. The subject of clean energy is widely emerging with new technology solutions to achieve the sustainability targets. Hence there is a strong need to identify emerging technologies and the solutions to create new opportunities to meet clean energy targets in the coming decade. We hope that this thought leadership initiative and the associated investment ideas help showcase promising areas of innovations and thus drive stronger market as well as bring forth public and private sector interest to foster them further.

Amit Kumar
Partner-Clean Energy
PricewaterhouseCoopers Pvt Ltd

Quotes from Community Leaders

"Decentralised Renewable Energy creates access to improved quality of life, uplifting communities from under-served conditions. Localised clean energy democratises the power of choice - of better healthcare, education, livelihoods - and transforms villages to sustainable societies."

Adwait Joshi
CEO, CLEAN

"Renewable Energy & CleanTech will play a vital role for India in achieving its SDGs. IFP's top 10 Impact Investment Ideas for the decade will be the building blocks for this process. It was wonderful to be part of such a group with diverse expertise."

Amarjeet Singh
Partner, KPMG

"Curation of investment options in Renewable Energy and Cleantech is crucial to give direction and drive mandates towards credible initiatives. IFP's multi-stakeholder engagement and peer reviewed white-paper approach is directed at long term impact. We have a short window to mitigate climate change. Together, we need to get into action mode in priority on these concepts, invest risk capital behind them and be forgiving if some innovations miss their mark !"

Amit Raje
Chairman & MD, Aartech Solonics

“Setting up coal-fired power plants in India today would be the equivalent of planning, in the early 1900s, a 50-year infrastructure for horse drawn carriages! #NoToCoal.”

Ashish Mehta
Founder & MD,
Second Nature

“The Renewable Energy landscape is fast changing and scaling at the same time, with new technologies and markets opening up quickly. IFP's approach for REN gave us a chance to explore a wide array of opportunities and focused on the most urgent areas requiring action.”

James Abraham
Founder & Director,
SolarArise

“It is the right time to direct impact focussed investments towards the Renewable Energy and CleanTech sector. IFP as a platform will play a vital role in guiding those investments with the TOP 10 Impact Investment Ideas to invest in, over the next decade.”

Jitendra Routray
Head-CSR,
Renew Power

“It is a great platform to understand gaps and needs in the market and exchange solution & business model ideas to create scalable renewable energy solutions to provide great impact.”

Hariharan V S
Co-Founder,
Third Wave Power

“Renewable Energy and Clean Tech is crucial to solving the Climate crisis that we all face. IFP has successfully built a multi-stakeholder platform to debate and find solutions to address this important problem.”

Jamuna Rao Verghese
Managing Partner,
Dancing Rain Capital

“Renewable energy is front and center of India's ambitious climate change mitigation plans. IFP can play a catalytic role in finding unique renewable energy focused solutions to climate change problems.”

Mayank Chaudhary
Head-Private Sector
Infrastructure Finance, ADB

“Society needs affordable and sustainable energy solutions to advance global development and prosperity. At bp, our strategy is designed to meet this dual challenge so that we, as a company and our stakeholders, can achieve net zero. We are developing low carbon solutions to help countries, cities, corporations and consumers do the same for a sustainable future. IFP provides a unique opportunity to generate and exchange innovative ideas towards this goal.”

Rajeev Kumar
VP & Director,
BP

“Distributed Renewable Energy needs champions who can understand the energy needs of poor people, innovate to deliver affordable products and work towards eliminating barriers impeding access to sustainable energy.”

Svati Bhogle
Founder,
SustainTech India

“Investing in green and efficient energy can have huge socio-economic and environmental implications. Transitioning away from legacy systems around utilities to more decentralized models could ensure higher flexibility and equity.”

Rekha Krishnan
Founder,
WEFT

“With organizations aiming to build sustainable products and businesses, IFP has successfully built an institutional approach where long-term organizations can hold themselves accountable to a public standard, while continually improving.”

Tarun Mehta
Co-Founder & CEO,
Ather Energy

Introduction

As countries around the world ramp up their efforts to restrict global mean temperature increase to less that 1.5 degrees Celsius, it is encouraging to know that global renewable energy capacity addition in the past year has been greater any year preceding it, despite the economic slowdown caused by the pandemic. The amount of renewable energy added was around 260 GW, which exceeded 2019's expansion by nearly 50 percent.[1] The Asia-Pacific region is largely responsible for this increase, owing to its status as a global renewable leader. As the fastest growing region in the world, the economic transformation and energy transition of this region is central to any global agenda to mitigate global warming and achieve sustainability goals.

Within the Asia-Pacific region, India is the largest country after China in terms of renewable energy potential. However, the country has not yet fully embraced the idea of a non-fossil fuel powered country, and for this reason, India is the fourth largest global emitter of greenhouse gases globally.[2] India is the second largest coal importer in the world, despite it being the country with the fourth largest coal reserves.[3] This heavy reliance on coal, which makes up over 50 percent of the country's installed power capacity, has impeded the country's push for a greater share of renewables in its energy mix. India is home to one of the largest clean-energy expansion programs. In 2015, the Government of India set itself an ambitious target of ramping up renewable energy capacity to 175 GW by 2022.

India is party to the Paris Agreement, an international treaty which set a goal of limiting the increase in global temperatures by less than 2 degrees Celsius. To achieve this goal, each participant country was expected to come up with action plans to curb emissions (also known as INDCs- Intended Nationally Determined Contributions). As part of its INDCs, India pledged to attain 40 percent of its total energy from renewable energy by 2030,[4] an ambitious goal, given that India's energy mix is still fossil fuel dominant (>80 percent).

India's Intended Nationally Determined Contribution (INDC) outlines the country's post-2020 climate actions. A range of policy instruments in the renewable energy sector have been adopted to implement the actions identified under INDC. Owing to this, India has successfully created a positive outlook necessary to create demand for and supply of renewable energy under the aegis of Ministry of New & Renewable Energy (MNRE).

This book lays out investment ideas that has the potential to attract impact investments in innovative business models of renewable energy and other areas that can help transform not only the energy usage pattern of the country but also provide a sustainable energy source for generation to come. A survey identifying the potential of top 10 impact investment ideas in Renewable Energy and CleanTech on various impact parameters is given on the next page.

[1] https://www.irena.org/newsroom/pressreleases/2021/Apr/World-Adds-Record-New-Renewable-Energy-Capacity-in-2020

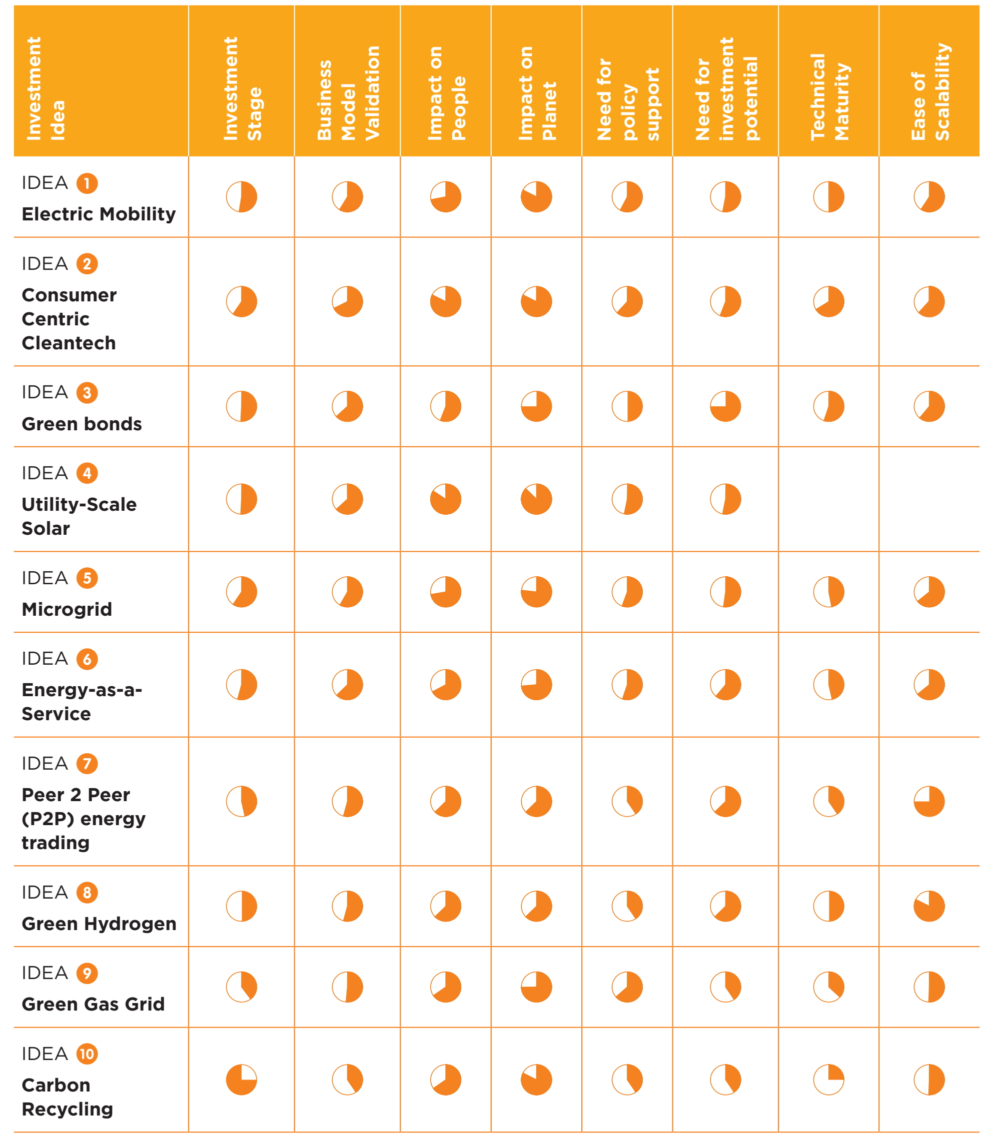
[2] https://www.statista.com/statistics/271748/the-largest-emitters-of-co2-in-the-world/

[3] https://www.reuters.com/world/india/why-is-india-facing-coal-shortage-2021-10-01/

[4] https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf

RENEWABLE ENERGY & CLEANTECH

RANKING OF THE TOP 10 IDEAS



Shifting towards a Clean Renewable Future

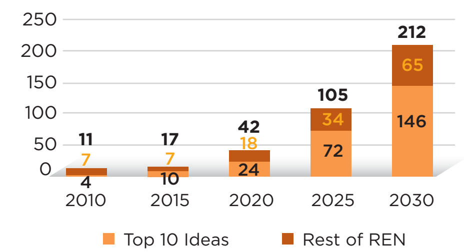
India ranks third among countries in Renewable Energy Country Attractiveness Index (RECAI) 2021,[5] with strong focus by the government on promoting renewable energy in India. India is also responsible for initiating the International Solar Alliance, an alliance between 124 countries lying partly or completely in between the Tropics. Currently, solar accounts for 4 percent of India's total electricity generation, while coal stands at 70 percent. Driven by India's policy ambitions and Solar's cost competitiveness, coal and solar are expected to converge at around 30-35 percent by 2040.[6]

Apart from solar, India also has a huge untapped potential with respect to hydropower. Hydropower has faced several roadblocks in the past years[7] but despite this, as per RECAI, hydropower has the potential to be the largest source of clean energy after solar. Wind energy too shows great potential in India and there was steady growth observed between 1985 and 2015. However, following this, wind energy lost favor in the Indian market, and the growth of this energy source slowed down considerably.[8]

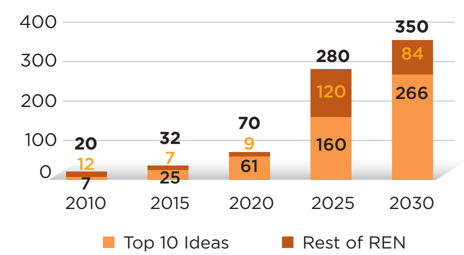
India has been able to evolve from being energy deficit to energy surplus owing to regulatory and operational reforms such as delicensing, unbundling of electricity sector, DISCOMs restructuring, renewable purchase obligations (RPO), open access, privatization, Time of Day tariff scheme, multi-year tariff frameworks, setting up regulatory bodies and through various other technical changes to bring down Aggregate Technical & Commercial losses. However, the schemes implemented so far have not been able to ensure a sustainable turnaround of the power sector.

Major legislative amendments and policy changes have been made and are underway at the central level to create an enabling

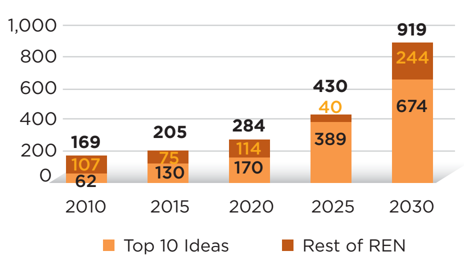
Revenues (USD Bn)



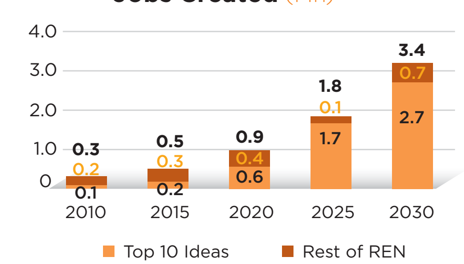
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



environment for the nationwide growth of renewable energy. This includes Electricity Act 2003, the National Tariff Policy and Draft Renewable Energy Act, RPOs, rooftop solar scheme etc. The draft Electricity Act Amendment 2020 proposes a roadmap for expeditious grid decarbonization through national renewable energy policy with a larger thrust on RPOs and Hydropower Purchase Obligations (HPO).

From the past decade, renewable energy has started playing an increasingly important role for augmentation of grid power, providing energy access and helping India pursue its low carbon development path. Government of India has rolled out National policies and schemes for the successful implementation of various renewable and energy efficiency projects like Faster Adoption and Manufacturing of Hybrid and Electric vehicle (FAME) and Production Linked Incentives (PLI) Scheme for promoting electric mobility. Recently government has rolled out schemes like 100 percent FDI under the automatic route[9] and hydrogen fuel cell vehicles for the e-mobility segment.

Similarly, MNRE has plans to set up a target for 40 industrial solar parks with a combined capacity of 40 GW by 2022. In order to achieve the same, the GOI has launched a number of initiatives to set up power projects with capacities of over 5000 MW, in regions including the Andaman and Nicobar Islands and the Lakshadweep Islands.

The transition to renewable energy in India is a journey filled with obstacles, but with advancement in technology, smart investments and attempts in efficiency enhancement through research and development, the country can easily achieve a renewable-dominant energy mix. Some of the challenges specific to India are described briefly below:[10]

The power distribution companies in India (DISCOMS), mostly owned by the government, are in poor financial positions. The consequence of this is that all renewable energy purchased by these discoms result in long, unsustainable payment cycles. This is reflected in the fact that in December 2020 over USD 14 billion of payments that were supposed to be made by discoms to power generators were delayed. Secondly, as the percentage of renewable energy in the energy mix increases, there is an associated variability in the generation of this power due to the dependence on weather conditions. To solve this issue, there needs to be a focus on forecasting and scheduling of winds and solar power. Thirdly, India's continued focus on coal calls for a change in mindset shift at policy level that still believe that sustainability has to come sequentially after development.

India also has a weak transmission grid. This becomes a challenge as renewable energy projects are very often set up in remote places. A Clean Energy Corridor program was initiated in 2013 to strengthen the grid, but this failed due to financing and land acquisition hurdles. Finally, India produces more power than it can consume. As a result of this, 19,000 MW of renewable energy potential remains unfulfilled, due to unsigned Power Purchase Agreements, which dampens investors' sentiments.

Considering a target of 500 GW from renewables by 2030, India would need funding of around USD 350 billion during 2023-2030. This presents a massive untapped investment potential to the tune of USD 30 billion on an annualized basis.[11]

[5] https://www.ey.com/en_in/recai

[6] https://www.iea.org/reports/india-energy-outlook-2021

[7] https://www.thehindubusinessline.com/opinion/indias-true-hydropower-potential-remains-untapped/article31580979.ece

[8] https://www.downtoearth.org.in/blog/energy/renewable-energy-india-s-wind-power-sector-is-in-a-downward-spiral-69251

[9] https://fame2.heavyindustry.gov.in/

[10] https://www.indiaspend.com/data-viz/renewable-energy-challenge-distribution-companies-forecasting-grid-infrastructure-768928

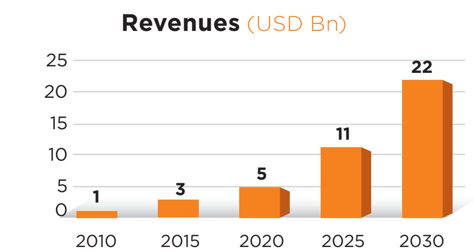
[11] https://www.weforum.org/agenda/2020/01/india-new-hotspot-renewable-energy-investors/

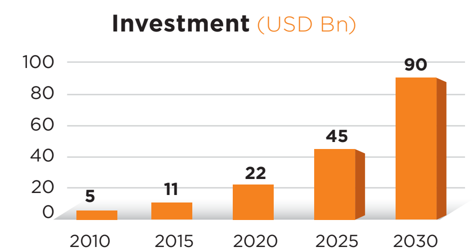
INVESTMENT IDEA 1

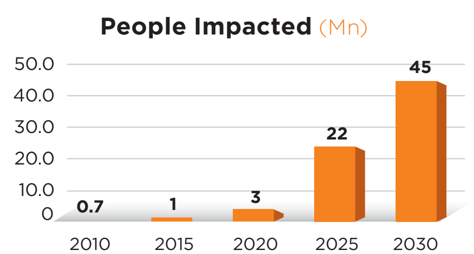
Electric Mobility

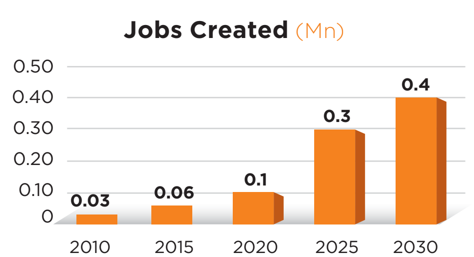
Ever increasing energy demand and greenhouse gas (GHG) emissions due to the use of Internal Combustion Engine (ICE) vehicles has paved the path for electrification of road transport. Three main imperatives drive the growth of electric vehicles (EVs): the reduction of petroleum imports, the carbon footprint and vehicular emissions. Electric mobility presents a viable alternative for addressing issues such as emissions, travel demand and energy security, when packaged with innovative pricing solutions, appropriate technology, and support infrastructure.[12]

Today, transport contributes approximately a quarter of all energy-related carbon dioxide (CO2) emissions, and is set to reach one-third, growing faster than any other sector. Moving to EVs can reduce emissions substantially. As per a report by the Intergovernmental Panel on Climate Change (IPCC), the total CO2 emission reductions from two-wheeler and four-wheeler electric vehicles are estimated at 7,000 tCO2/km. Since EVs are almost five times more efficient than similar ICE vehicles, moving to them will also reduce oil imports and help decrease the current account deficit. The global passenger car fleet is projected to double by 2050, with most of the growth taking place in developing markets, where an estimated three out of four cars will be found. Yet, while developing countries have the fastest growing fleets, most have no vehicle emissions standards, programmes, and incentives in place to promote zero emission vehicles.[13]









In India, the electric mobility sector is still nascent. Policymakers in India have set a goal of 30 percent penetration of EV in new sales by 2030. Also, the Government of India (GoI) has targeted 100 percent electric mobility by 2030. India's renewable energy generation capacity (including hydro) is more than 119 GW. As per a recent notification of the Production Linked Incentive Scheme by the Union Government, a total financial outlay of USD 3.5 billion for a period of 5 years will be provided to support the manufacture of auto and auto components based on automotive technology. There is a surge in strategic partnerships between OEMs and charging infrastructure operators such as TATA Power- TVS and Aether-Inox to build the EV ecosystem in the country.

Since the volume of EV business in the initial years is very low, attracting private investment in creating an Electric Vehicle Service Equipment (EVSE) network has proved a challenge in every country. Most have resorted to grant funding or capital expenditure (capex) by electric utilities. The various business models pertaining to utility are:

- **EV manufacturer model** including manufacturing and related activities
- **Charging infrastructure model** covering public infrastructure model and private infrastructure model
- **Battery leasing, swap schemes, scrapping policy** that includes battery replacement and scrappage incentive and buyback incentives
- **Purchase incentives** including fiscal incentives for the purchase of electric vehicles depending upon battery capacities.

In 2013, the GoI launched the National Electric Mobility Mission to incentivise the use and production of electric vehicles, aiming at the production of 6-7 million electric/hybrid vehicles in the country and the development of charging infrastructure to the tune of USD 110 million. Further, to incentivize the adoption of EV, the GoI also introduced the Faster Adoption and Manufacturing of Electric Vehicles in India (FAME) scheme to support market development and manufacturing of electric vehicles.[14]

The automobile sector contributes 49% of India's manufacturing GDP and 7.1% of its GDP. As part of the 2015 Paris agreement, India committed to reducing the emission intensity of its GDP by about 35% of 2005 levels by 2030. The EV market in India is expected to reach USD 2 billion in size by 2023.[15] Some of the most prominent reasons for investing in electric mobility in India include favourable government schemes incentivizing electric mobility, the FAME scheme to install 14,000 charging stations, rising fuel prices, increased motor vehicle tax and registration charges, tax subvention of EVs, subsidized tariffs for EV charging, attractive demand aggregation models and opportunities to set up EVSE infrastructure, battery manufacturing, component and vehicle manufacturing.

The high upfront cost of EVs, constraints in battery manufacturing, setting up EV charging infrastructure, and augmenting the power distribution network are a few concerns and challenges that impede penetration. As per the India Smart Grid Forum and Centre for Climate and Energy Solutions, since large volumes are not expected before 2025, there is no return on investment in an EVSE business even if grid upgrade cost is absorbed by the distribution company and land for EVSE is allotted free by local governments along with halving the cost of EVSE.

[12] https://beeindia.gov.in/content/e-mobility

[13] https://www.unep.org/explore-topics/transport/what-we-do/electric-mobility/why-does-electric-mobility-matter

[14] https://fame2.heavyindustry.gov.in/

[15] https://www.investindia.gov.in/sector/automobile/electric-mobility

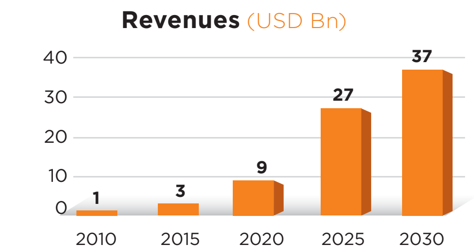
INVESTMENT IDEA 2

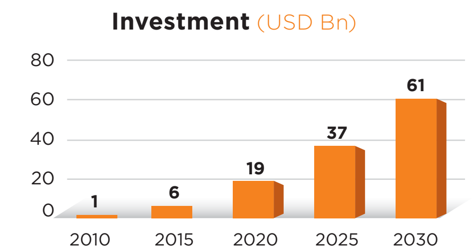
Consumer Centric Cleantech

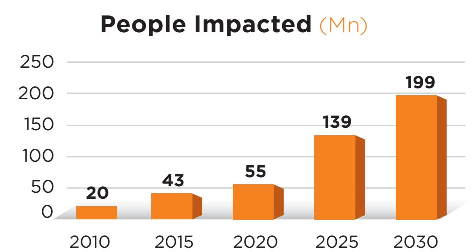
The energy sectors in Europe, Asia and Africa have been plagued by rigid delivery structures, regional monopolies, and stable customer bases with low churn rates for decades.[16] Consumers are rarely given a say in developments in the sector. For example, until very recently, end users in Germany or in India had no choice or say over what type of electricity metering equipment would be installed in their homes. Instead, the supplier was force-fed based on what the regional government had authorized.

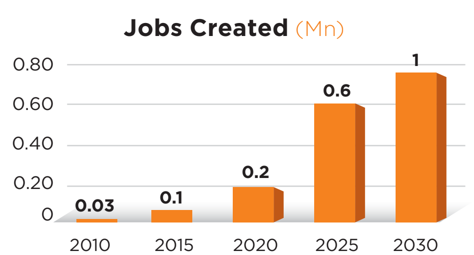
Today, however, utilities are moving away from the one-way distribution model and their traditional role as energy providers. There is new demand for customer-owned technologies such as solar rooftops, energy management systems and smart devices. New customer-centric products (those more aligned with customers wants and needs) are being introduced in the energy sector to produce clean energy using technology.[17] The term for these products is 'consumer centric cleantech'. Customer feedback is central to these products, and as a result, utilities are developing smart platforms driven by real-time customer experience data to optimize their products. As utilities move in the direction of supplying power and providing services, while accommodating customer preferences, it is vital for them to have a long-term technology plan. Investments in technology should be made in a manner that they serve as steppingstones to support programs that the company plans to launch in the future.

With the development of advanced technology solutions, energy products and services are not unilaterally controlled by utilities. Now that viable alternatives exist, consumers have started to question their relationships with power companies









more critically than before.[18] This change in consumer behaviour, working in tandem with liberalized energy markets and a global political push for clean energy, could force power companies to change the way they do business First and foremost, companies will need to take a more customer-centric approach to their businesses. Research has revealed a delivery gap in the power sector, which means that utility companies tend to have an overoptimistic perception of customer satisfaction, compared to actual customer satisfaction.[19] By introducing customer-centric cleantech, players in the power sector have a golden opportunity to bridge the delivery gap, as well as build on their customer base, and stay relevant in a constantly changing market.

Within the energy sector, a more customer-centric approach will depend heavily on digital platforms and services. These platforms shape the entire customer experience and have a huge impact on consumers' everyday lives. Additionally, digital services will bridge the divide between consumers and power companies, allowing for better communications between the two. If the supply side fails to act now, they will have problems keeping their customers satisfied in the future.[20] Instead of focusing only on their competitors, power companies should be taking cues from successful industries like entertainment, retail and mobility services, and aim to match their standard of customer experience.

Energy users can also incorporate flexibility into their business model, which is indispensable for a renewables-based system. Flexibility from demand response, the smart management of energy resources, and storage can complement the growing variability in energy supply. A substantial number of industrial processes, commercial buildings, private homes, and electric vehicles can be operated flexibly with only very limited investments.

The concept of customer-centric clean tech driven by customers is gaining popularity in Europe and in North America. Many customers are now proactive, engaged prosumers, choosing how their power is generated and some generating it themselves. Yet other customers remain passive acceptors of whatever is delivered to them at the end of the energy supply chain.[21]

In the last five years, 8GW of new renewables have been contracted in Europe through corporate power purchase agreements and at least another 10GW have been installed onsite. It's estimated that by 2030, energy communities could own up to 20 percent of wind and solar capacity in Europe and by 2050, more than 185 million EU households could demand response, storage and renewable energy production. The European Commission has assessed the potential of flexibility from demand response alone to be 160 GW by 2030 already. There are very few customer-centric cleantech companies in India. Oorjan and Skilancer are two companies that offer solar solutions at a household level, while Log9 materials uses nanotechnology to revolutionise the energy sector with an innovative zero emission and low-cost aluminium-air fuel cell.

Some of the major risks and limitations of investing in consumer centric cleantech include lack of a liberalized market, non-availability of consumer centric cleantech options, threat to data security, and a lack of consumers motivated to change from the existing mode of energy supply.

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[16] https://electricenergyonline.com/energy/magazine/1025/article/A-Vision-of-the-Customer-Centric-Grid.htm

[17] https://www.power-grid.com/customer-service/how-customer-centric-should-utilities-be/#gref

[18] https://www.homeserveutility.com/a-customer-centric-solutions-approach-to-energy/

[19] hhttps://www.tdworld.com/electric-utility-operations/article/21126945/customer-satisfaction-with-utilities-falls-again-study-shows

[20] https://www.innowatts.com/insights/electricity-providers-customer-centricity/

[21] https://energycentral.com/system/files/ece/nodes/383737/innogy_consulting_customer_centricity.pdf

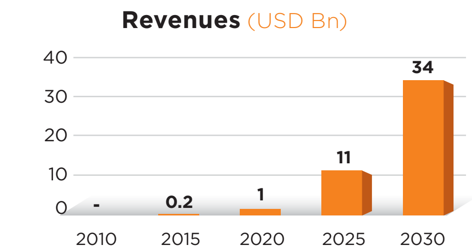
INVESTMENT IDEA 3

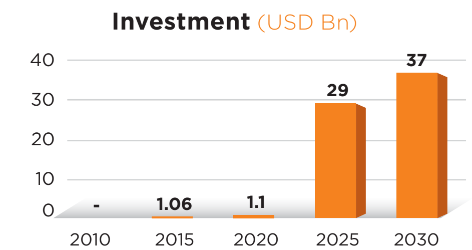
Green Bonds

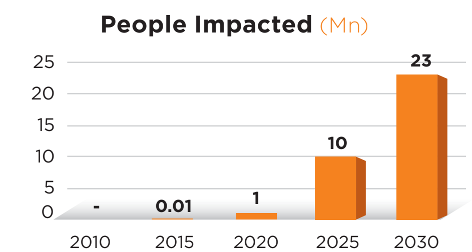
Green bonds are financial instruments that are used specifically to raise money for climate and environmental projects. They are one of the more prominent innovations in the field of sustainability finance and have gained immense popularity in the last 10 years. The first green bond was issued in 2007, and since then, more than 1 trillion USD worth of such bonds have been issued.[22] Interestingly, the buyers of a green bond have recourse to the entire balance sheet of the issuing company, which eliminates the risk associated with the actual project that the bond is financing.[23] Green bonds can be viewed as a tool to shift capital from less sustainable to more sustainable investments.

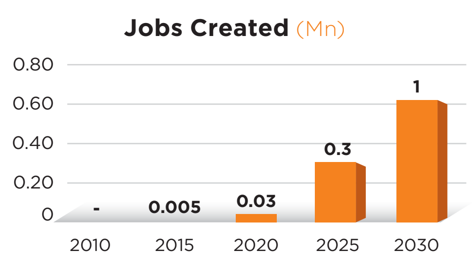
One of the major global issuers of green bonds is the World Bank, which has issued over USD14 billion of green bonds. The proceeds of these have gone on to finance a number of projects around the world (111), focusing largely on renewable energy (33%), clean transportation (27%) and agriculture (15%). India was one of the first regions where World Bank green bonds were utilized, for the Rampur Hydropower Project, which was conceived to supply renewable-based power to the electricity grid in North India. This project was a success, producing close to 2MW annually, while also offsetting 1.4 million tons of carbon emissions.

The global reputation of sustainability financial tools is at an all-time high, with issuance of bonds for ESG goals set to hit an unprecedented USD 1 trillion this year. This value is more than double of what was sold in the previous years, most likely due to pressure on borrowers to sell ethical debt by investors. Despite these seemingly large numbers, green bonds still only constitute 1 percent of global bonds, giving them huge potential to grow in the coming years.[24]









Green bonds have shown to have several benefits, for both investors and issuers. For investors, green bonds offer similar returns compared to conventional bonds, while also allowing investors to diversify. Green bonds in some cases may even offer tax benefits to investors. For issuers, creation of green bonds has a positive impact on brand image, especially today, when addressing issues like climate change and sustainability have gained global traction. By issuing green bonds, companies are essentially creating a new market, which helps attract new investors, in addition to the existing ones, thereby broadening their customer base.

At a global level in 2021, sustainable finance bonds issuance was at USD 286.5 billion in Q1, a figure more than double of what was issued in the same quarter the previous year.[25] As the world shifts towards sustainable development and net zero goals, society is becoming more and more conscious of the impacts of their investment decisions. Green bonds have made a marked impact in Europe and USA, especially in the Scandinavian countries. Large private companies, like Apple, Walmart and Volkswagen also entered into issuing green bonds and funding green bond projects.

Even in India, green bonds are gaining popularity, with a number of state and private players trying to get involved. In 2021, through an issue of ESG and green bonds the Indian companies raised nearly USD 7 billion as compared to USD 1.4 billion and USD 4 billion in 2020 and 2019, respectively.[26] The Ghaziabad Municipal Corporation became the first municipal corporation to issue a green bond, raising USD 20 million, in order to build a tertiary sewage treatment plant.[27] There are also a number of banks like Yes Bank, Axis Bank, State Bank of India and Exim Bank that have developed green bond frameworks and made a foray into the field themselves. Several agencies like the USAID Partnership to Advance Clean Energy Deployment, technical assistance program have been actively promoting the use of Green Bonds in India since 2013. The program aims to align issuers, investors and verifiers to understand the usefulness of green bonds in improving costs, access to capital, and asset-liability mismatch for their RE portfolio.

Despite the immense popularity and growth of green bonds off late, a few challenges to these bonds have also been identified. The issuance process of green bonds is a complex and expensive process. Conceptually green bonds should have the same credit rating as conventional bonds, given that the same balance sheet backs them. However, for a bond to be truly green, it needs to undergo scrutinization to ascertain its green credentials. This scrutinization involves certifications and audits, which imposes additional costs.[28] Green bonds constitute only 1 percent of total bonds issued. This means that the pool of green bonds is shallow, which has potentially negative implications for liquidity. Green bonds are prone to face the issue of Greenwashing, a situation where companies misinform investors about the nature of their offering to make it seem more sustainable than it actually is.[29]

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22 https://www.climatebonds.net/market/explaining-green-bonds
23 https://www.tandfonline.com/doi/full/10.1080/20430795.2020.1724864
24 http://www.gogreenbonds.org/why-green-bonds/
25 Sustainable Finance: The Big Picture, Capco
26 https://www.financialexpress.com/industry/banking-finance/esg-green-bonds-issue-rise-sharply-in-2021-as-indian-firms-promote-sustainable-business/2379438/
27 https://www.forbesindia.com/article/sustainability-special/green-bonds-sustainable-bonds-demand-picks-up-in-india-in-the-pandemic-era/68141/1
28 https://www.intuition.com/green-bonds-are-growing-fast-but-there-are-challenges/
29 https://www.iflr.com/article/b1lmxbv3f6b5td/critical-challenges-facing-the-green-bond-market

INVESTMENT IDEA 4

Utility-Scale Solar

A utility-scale solar facility involves large-scale, reliable and clean electricity generation using solar photovoltaic power or a concentrated solar power plant. It feeds electricity directly into the grid, guaranteeing energy through Power Purchase Agreements (PPA) for a fixed term and with a stable fuel price for decades.

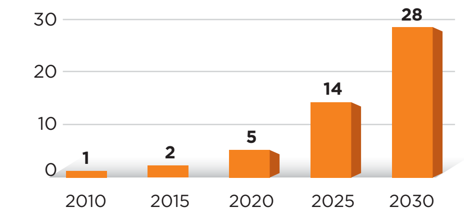
The IPCC's Fifth Assessment Report (AR5) sets recommended emission benchmarks to keep warming to below 1.5 °C or 2°C by 2050 by reducing GHG emissions to 40-70% or 70-95% respectively below 2010 levels. The Paris Agreement aims at reducing energy-related GHG emissions by around 3.5% per year from now until 2050, with continued reductions thereafter. To achieve these goals, it is crucial to decarbonise the world's energy system by adding renewable capacity such as wind, hydroelectricity, tidal and solar.

Solar power generation has proven to be one of the most attractive options for electrical energy production in grid-connected and distributed modes owing to its cost effectiveness, reliability and predictability. Also, solar power generation has high potential to become sustainable and competitive with fossil-fuel power generation within the next decade.

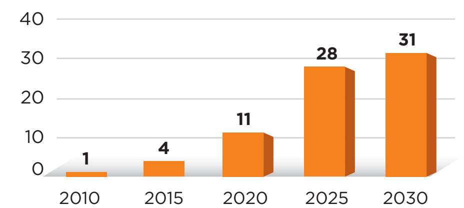
In India, the Ministry of New and Renewable Energy (MNRE) targets setting up renewable energy capacities to the tune of 227 GW by 2022, expanding to 450 GW by 2030, of which **about 114 GW** is planned for solar. Some major investments in solar power under the MNRE are as follows:[30]

- Under the Union Budget 2021-22, the government has provided an additional capital infusion of USD 137.04 million to the Solar Energy Corporation of India

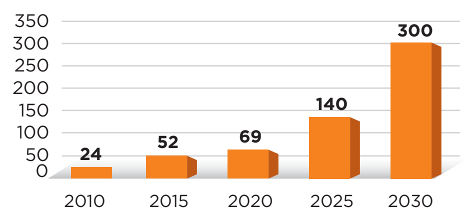
Revenues (USD Bn)



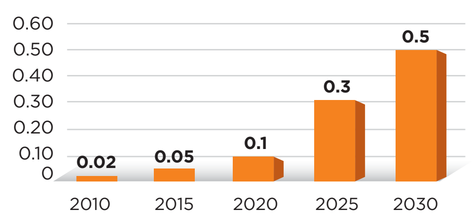
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



- To date, 60 solar cities have been approved and around USD 1.3 billion has been allocated for setting up 40 solar parks with a combined capacity of 40 GW by the GoI
- In April 2020, Vikram Solar bagged a 300 megawatt (MW) solar plant project for USD 250.39 million from the National Thermal Power Corporation Ltd
- Adani Group aims to become the world's largest solar power company by 2025 and the biggest renewable energy firm by 2030

With the accelerated penetration of photovoltaics (PV), utilities are becoming critical stakeholders with greater integration of PV systems into the grid. Emerging technologies and clear business/regulatory models are aiding this process, making them more viable and valuable, and allowing them to recover high distributed PV costs. The various business models for utility-scale solar are as follows:

- **Utility programs supporting current PV business models** such as financing and technology partnership
- **Utility PV ownership** including customer site PV and solar shares
- **Service agreement** such as land lease to project developers with the option to transfer ownership to the utility
- **Utility-owned and utility-controlled** where the control of PV assets would be integrated into the utility's overall distribution network and planning processes
- **Third-party or customer-owned and utility-controlled** model where high penetration of PV systems may pose serious grid control and operations issues.

Solar energy capacity has increased by approximately 60 percent over the last five years, rising to 627 gigawatts (GW) globally in 2019. China, the US, Japan, Germany and India lead renewable energy capacity in the world. According to the International Energy Agency (IEA), solar is on track to set records for new global deployments each year after 2022, with an average of 125 GW of new capacity expected globally between 2021 and 2025.[31]

As of August 2021, India's solar installed capacity stood at 44.3 GW, making it the world's fifth-largest installed solar capacity nation.[32] Energy demand across India is expected to grow more than in any other part of the world over the coming decades and, as the world's third-largest carbon emitter, the country is framing policies to shift away from fossil fuels like coal in favour of renewables. India is home to the world's largest utility-scale solar installations. As stated before, the MNRE has set a target of 40 industrial solar parks with a combined capacity of 40GW by 2022.[33] By 2040, the IEA expects solar to hold a roughly 31% share of India's energy mix under currently stated policy ambitions, compared to less than 4% today.

Despite its many advantages, investing in utility-scale solar has associated risks. They include political instability in a region, interest rate levels and currency exchange rates or future energy price, deviations between expected and actual lifetime energy yield of a PV power plant, cost of PV generation exceeding that of other energy delivery options, low market penetration and lack of a clear business/regulatory model that allow utilities to recover high distributed PV costs.

[30] https://www.nrel.gov/docs/fy08osti/42304.pdf

[31] https://www.iea.org/reports/renewables-2020/solar-pv

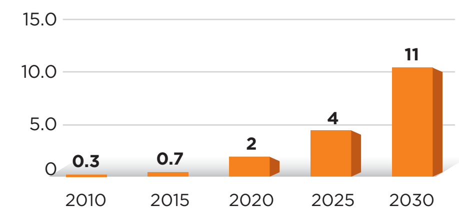
[32] hhttps://mnre.gov.in/

[33] https://ieefa.org/wp-content/uploads/2020/05/Indias-Utility-Scale-Solar-Parks-Success-Story_May-2020.pdf

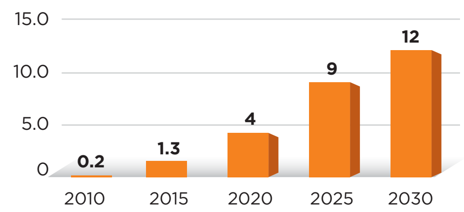
INVESTMENT IDEA 5

Microgrids

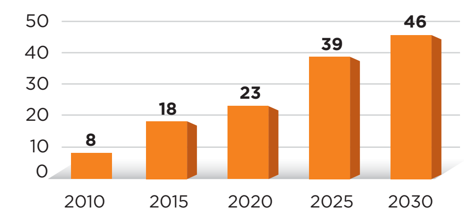
Revenues (USD Bn)



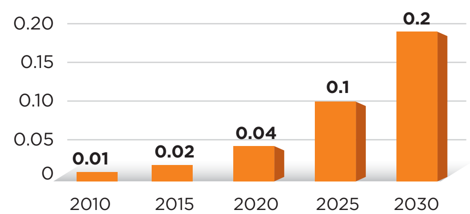
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



A microgrid is an autonomous, stand-alone and decentralized energy system capable of operating on an 'island mode'. Microgrids act as local energy sources where power transmission and distribution from a major centralized energy source is too far and costly to execute such as rural electrification in remote areas and on smaller geographical islands.

Today, over 800 million people in the world lack access to dependable electricity.[34] When macro grids are unable to serve, localized microgrids can mitigate power disruptions by continuing to provide electricity to local customers. Microgrids can run on renewables, natural gas-fuelled combustion turbines, or emerging sources such as fuel cells or even small modular nuclear reactors when they become commercially available. Microgrids provide efficient, low-cost, clean energy, enhance local resiliency, respond dynamically in unprecedented times and improve the operation and stability of the regional electric grid.[35] Since microgrids integrate renewable energy, energy storage technology, and advanced grid-management software, they become even more attractive to deploy. The following business models are typically employed for microgrids to meet relevant pricing options and financing implications:[36]

- **Customer-owned** where capex, technology risk, ownership, operations and management (O&M) are borne by the energy user such as a single building or contained campus
- **Renewable energy service company (RESCO)-owned**, where RESCO owns the grid and takes care of all capex, risks, O&M, contracting modalities, etc.
- **Cooperative-owned** including local electricity consumers, typically commercial and industrial consumers, where capex and technical risks are borne by the local cooperative, while a third-party provider takes care of O&M
- **Community-owned** including a community of individual retail/residential consumers where again capex and technical risks are borne by the community involved, while third party service provider take care of O&M
- **Pay-as-you-go** (typically rural remote mini-grids), where capital expenditure, risks and asset ownership lie with investors and O&M with third party services providers
- **Remote** (non-grid connected), on a similar model as community-owned, except that the contracting modalities employed in this approach are either build-own-operate or anchor-business consumer mode.

Governments across the globe have come up with net metering policies and regulations, technical standards and specifications for grid interconnection, open access or contestable consumer models, financial incentives, and risk sharing mechanisms for the implementation of off-grid and grid-connected microgrids in their energy systems. Pilot and demonstration microgrids along with remote rural and island microgrids have been deployed in many countries to bring energy to remote rural/island communities running on alternative energy. Today microgrids in rural areas across sub-Saharan Africa and Asia are using control and data management systems as sophisticated as those utilities use in major cities.

TP Renewable Microgrid Ltd., an initiative of Tata Power supported by the Rockefeller Foundation, has come up with a plan to provide clean, reliable, affordable power to 10,000 villages across India, directly impacting the lives of 25 million people over the next decade. This partnership will unleash local economic opportunities, driving energy consumption and living standards in a manner that is consistent with shared global climate goals.[37] There are other major players in this growing space. PowerGen, the market leader in Africa, has rapidly scaled up from 60 microgrids at the end of 2018 to 193 sites currently. PowerCorner, the mini-grid arm of French multinational Engie, is operating nine microgrids with four more under construction, aiming to continually expand in the coming years.[38]

The GoI has issued a draft national policy on renewable energy-based mini and micrograds. The policy proposes to set up at least 10,000 renewable micro and mini grid projects across the country. These will have 500 MW of generation capacity to be developed by private players by 2022 to cater to around 237 million people experiencing energy shortages.[39] Large private investments, such as the partnership between Tata Power and Rockefeller Foundation, are setting up 10,000 microgrids by 2026 to support 100,000 rural enterprises, create 10,000 new green jobs and provide irrigation for over 400,000 local farmers.[40]

Currently, commercial investors are hesitant about investing in the microgrid market due to a perceived lack of visibility, market immaturity, and scalability concerns. Technology, regulatory, and business risks are manifested in barriers to achieving bankability and financial closure of microgrid projects. The technical and financial viability of microgrids is subject to risks in areas such as grid electrification, credit, technology and product, capacity utilization, and regulation.

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[34] https://www.tatapower.com/products-and-services/micro-grids.aspx

[35] https://www.c2es.org/content/microgrids/

[36] adb.org

[37] https://www.tatapower.com/products-and-services/micro-grids.aspx

[38] https://fortune.com/2020/01/21/microgrids-energy-poverty-africa-asia/

[39] https://www.indiasmartgrid.org/

[40] https://www.rockefellerfoundation.org/news/tata-power-rockefeller-foundation-announce-breakthrough-enterprise-empower-millions-indians-renewable-microgrid-electricity/

INVESTMENT IDEA 6

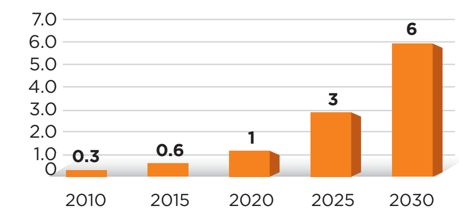
Energy-as-a-Service

Until recently, businesses have considered energy an expenditure that is not in their control. While a lot of information on energy is common knowledge, understanding energy markets is far more complex, due to changing regulations and volatile markets. This is where the Energy-as-a-service (EaaS) model comes in. In the EaaS model, a company partners with external energy experts, who offer end-to-end service to manage the company's energy expenditure in exchange for a recurring fee.[41] This differs from the conventional model where power is centrally generated and sold to passive consumers. These 'energy experts' have significant knowledge of the energy industry and apply it to offer energy saving solutions to clients based on the nature of the business.[42]

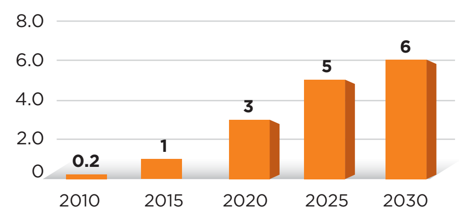
Energy systems and technologies are becoming increasingly complex, which is causing commercial, institutional, and industrial entities to seek out energy management solutions. Along with the pressure of meeting energy needs comes the additional onus of investing in sustainable energy to reduce the carbon footprint. In this context, EaaS offers solutions tailored to the specific needs of a company, allowing it to become more energy efficient (i.e., green) and save money, without the burden of having to manage the system themselves.[43] The 'energy expert' or service provider assumes the responsibility of energy management throughout the value chain. Customers also save on the capital investment in obtaining energy efficient equipment/devices. These are provided by EaaS providers as part of their service.

The EaaS business model has been made possible today because of digitalization, which helps convert data into big value and

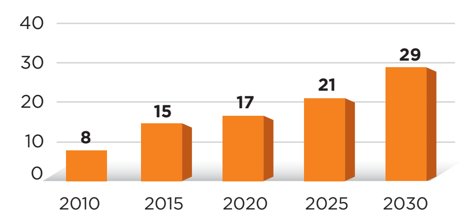
Revenues (USD Bn)



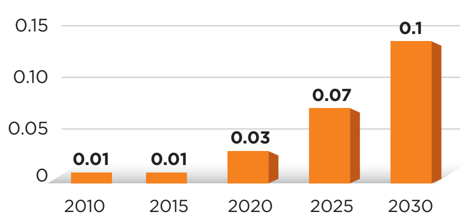
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



service for the power sector. Businesses with sustainability on their agenda and keen on energy saving benefits partner with an EaaS consultant. This consultant uses the latest technologies, along with his/her expertise to analyse the energy profile of a business, with the objective to optimizing the business' energy usage. Generally, an EaaS company makes two kinds of recommendations: how to save energy and make day-to-day operations more efficient, and alternative energy sources, including production and storage.[44] What makes the business model so attractive is that savings are guaranteed. If the strategies introduced by the EaaS company do not produce the savings promised, the difference is made up by the company itself.

Energy-as-a-Service can be compared to the service provided by taxi aggregators like Uber. Just as Uber offers inexpensive rides without the added cost of owning a car, EaaS can be described as having access to power without an actual power plant. The EaaS market consists of third-party vendors, utility services companies, and potential business model disruptors deploying niche technical, financing, or procurement solutions such as solar PV power purchase agreements, energy services performance contracts, and deregulated electricity market retail brokerage services. The growth of EaaS will bring about a change in the energy landscape, from being centralized, predictable, vertically integrated, and 'one way', to being distributed, intermittent, horizontally networked, and bi-directional. As commercial customers hunt new business models, EaaS providers fill the market gap by investing in large-scale generation and delivery assets, which enable pools of customers to tap those assets while still preserving their capital.[45]

The idea of EaaS is gaining traction in North America, South America, and parts of Europe. Based on consumption, Asia Pacific is projected to be the biggest market for this service, though it hasn't properly kicked off yet. The market for energy efficient services has grown exponentially in the past decade, with SolarCity, Sunrun and Vivint Solar being the largest players in the American market today. EaaS companies are coming up with innovative ideas to expand into the residential market, by offering monthly solar lease options, where fixed monthly payments are made for the use of the company's solar panels. AT&T, the largest telecommunications company in the world has used the EaaS model to upgrade systems, with great results. The company generated annual energy savings of nearly USD 20 million.[46]

Though the business is still in a nascent stage, it has huge potential going forward, as the world moves away from fossil fuel-based energy, and towards cleaner alternatives. According to business consulting firm Guidehouse, EaaS will grow globally by 32.1% every year between 2021-30. The market is valued at around USD 5.4 billion today and is projected to rise to USD 66 billion by 2030.

Some of the risks and limitations that restrict investment in EaaS are low customer awareness on the existence and benefits of EaaS, non-standardized practices/services offered, high transaction costs, and reluctance to give up control of energy assets.[47]

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[41] https://www.altenergymag.com/article/2019/11/how-the-energy-as-a-service-eaas-business-model-works/32225

[42] https://www2.deloitte.com/uk/en/pages/energy-and-resources/articles/energy-as-a-service.html

[43] https://www.smart-energy.com/industry-sectors/energy-grid-management/energy-as-a-service-solutions-grow-despite-the-pandemic/

[44] https://www.altenergymag.com/article/2019/11/how-the-energy-as-a-service-eaas-business-model-works/32225

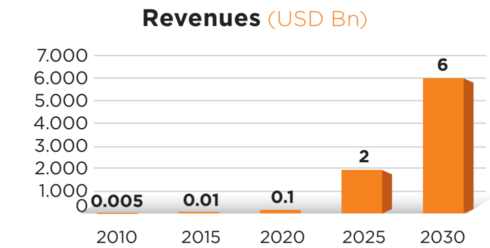
[45] https://energy.economictimes.indiatimes.com/energy-speak/energy-as-a-service-the-success-mantra-for-energy-optimization/4154

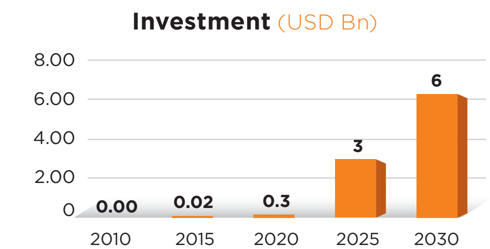
[46] https://www.rff.org/publications/issue-briefs/energy-service-business-model-expanding-deployment-low-carbon-technologies/

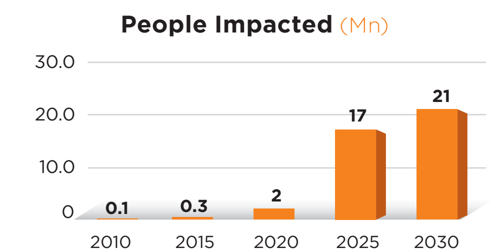
[47] https://www.environmentalleader.com/2021/10/energy-as-a-service-industry-expected-to-boom-in-the-coming-decade-says-guidehouse/

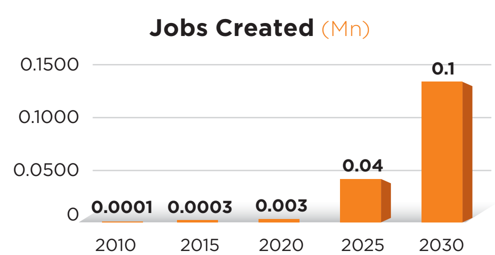
INVESTMENT IDEA 7

Peer 2 Peer (P2P) energy trading









Peer-2-Peer energy trading refers to buying and selling of energy between two or more grid-connected parties. It provides a choice to consumers to choose their electricity supplier as well as customer. It is based on an interconnected platform that serves as an online marketplace where consumers and producers “meet” to trade energy directly, without the need for an intermediary. Peer-to-peer (P2P) energy trading empowers prosumers and consumers, leading to increased renewable energy deployment and flexibility.

The increased penetration of Decentralized Energy Resources connected to distributed networks empowers consumers to generate the electrical energy they need and sell excess energy. Currently, excess renewable energy mainly solar energy is exported back to the grid for a small feed-in-tariff rate. However, this method is becoming obsolete with people looking out for flexibility and control in managing how their resources are distributed. Thus, trading of energy is preferred through a secure platform, like blockchain. Blockchain refers to a database technology that processes and stores information. Peer-to-peer energy trading allows consumers to share their excess energy amongst one another and controls the distribution. Thus, peer-to-peer energy markets appear to be a feasible solution to manage direct energy trading between the peers.

This online platform allows the local distributed energy generator to sell their electricity at the desired price to consumers who are willing to pay that price. The platform works like an open market economy, where suppliers seek the highest possible price, consideration their costs and profits and consumers, on the other hand, choose the lowest possible price for the power based on their needs and preferences. This platform provides leverage to prosumers who otherwise would sell the excess electricity to the grid at a “buy-back” rate which is quite low as compared to the consumer tariffs charged by the utility.

The P2P electricity trading model was born because of the increasing deployment of distributed energy resources connected to distribution networks, and the intention to provide more incentives to promote further deployment of these resources. In P2P electricity trading, prosumers are allowed to switch their roles between buyers and sellers to either purchase or sell electricity. The model allows direct trade of electricity with other consumers in order to achieve a win-win situation in terms of better outcome compared to relatively high tariffs and relatively low buy-back rates. This model allows buyers to save cost and sellers to make profit.

Some of the common ways to participate in P2P trading include;[48]

- Over the grid trading- active on trading platform without a private microgrid
- Partly independent microgrid- community grid with a back-up connection to the main grid
- Fully independent microgrid- independent microgrid with generation and storage components
- Negawatt – trading of saved energy units as a direct result of energy conservation results

With India aspiring for 500 GW of renewable energy by 2030, the energy sector will need a paradigm change in its mix. Renewable energy is, thus, set to emerge as a key energy source, redefining energy matrix at all levels- globally, regionally and nationally. Furthermore, Distributed Renewable Energy resources (DREs) like Solar photovoltaics, battery energy storage systems (BESS) and electric vehicles (EVs) are witnessing an exponential growth and are likely to become the mainstay of power generation in next few years, owing to the government-driven policy targets. To manage this distributed generation, a robust and technologically sound infrastructure will be pivotal to build sustainable and responsive energy economy, at the local level. Peer-to-peer energy trading will thus emerge as the next-generation management system for smart grids and be more efficient when equipped with DREs to trade energy. This trading platform can serve as a local energy market for buyers and sellers to gain price advantage. This platform can reduce overall operational costs of the power system, ultimately reducing electricity costs for consumers.

In Indian context, structural mechanisms, including smart grids, digitalizing the entire ecosystem and conducive regulatory frameworks are required for successful P2P trading. India’s Smart Grid plans are under progress with structural transformations being made in the distribution system, generator-consumer integration and system operations. For example, BSES Rajdhani Power Ltd (BRPL) has partnered with Power Ledger, an Australian specialist in blockchain based renewable energy trading to install a P2P energy trading trial in Delhi.

P2P trading brings in the question of data usage and protection in the context of electricity system operations. Although P2P trades, in principle are possible for long distance trades, yet the natural environment seems to be the local distribution grid or microgrid. This local dimension brings forward the questions about the role of the distribution system operator (DSO) in ensuring the smooth execution of P2P trades.

[48] https://www2.deloitte.com/nl/nl/pages/energy-resources-industrials/articles/cop26-peer-to-peer-energy-trading.html

INVESTMENT IDEA 8

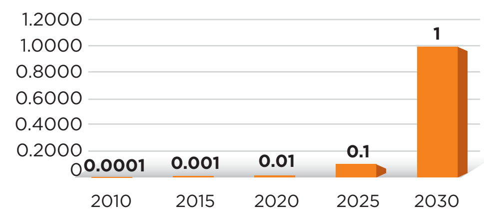
Green Hydrogen

Green hydrogen is one of the cleanest forms of energy in the world produced using renewable energy through electrolysis. Hydrogen can be produced using renewable sources like solar and wind through a process called electrolysis where water is split into its components, oxygen and hydrogen, and this hydrogen can be transported across any distance either in its gaseous or liquid forms, or as a compound with other elements, ammonia or methanol, etc. The advantage of electrolysis is that there is no greenhouse gas emissions as the only by-product left in the process is oxygen.

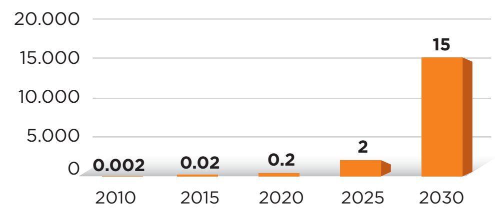
The Ministry of New and Renewable Energy (MNRE) has seen hydrogen as an area of strategic interest since at least 2006, when the first Hydrogen and Fuel Cell Roadmap was launched. The announcement of the National Hydrogen Energy Mission in the Union Budget of India 2021-22 is an indication of India's potential in building capacity to become the cheapest hydrogen producer in the world by 2050. Currently, the country is entirely depended on fossil fuel based hydrogen; however the country aims to replace almost three-fourth of all hydrogen generation to be green by 2050.[49]

Hydrogen is a key industrial commodity around the world that can be used and stored, thus bringing a strong need to generate and develop business models for production of green hydrogen. For India to guarantee its role as a technology leader in the next phase of the energy transition, it will need to greatly increase activity across the public and private sectors to develop a green hydrogen economy. India should focus public money for R&D and technology development to try and be on the global frontier in each part of the value chain of green hydrogen,

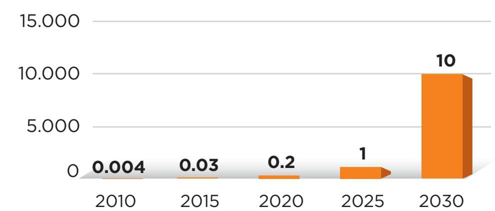
Revenues (USD Bn)



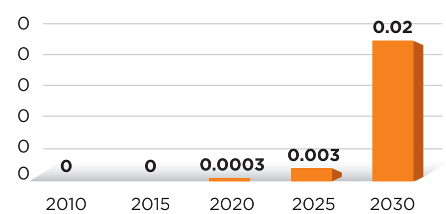
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



with the objective of lowering costs and increasing deployment. This requires a coordinated push from the supply-side, with increased investment and R&D commitments by government and industry, as well as demand-side support in the form of guaranteed markets, enabled by government procurement, subsidy schemes or regulations/standards on fossil fuel alternatives. Only through the mass manufacture and deployment of hydrogen technologies at scale will we see cost reductions where hydrogen can start to displace significant amounts of fossil fuel use, without government subsidy.

India is emerging as a front runner in its efforts to reduce global warming as the nation remains committed to substantially reduce its carbon footprint in near future. The National Hydrogen Energy Mission, announced in the Union Budget of India, 2021-22, is a giant step towards a greener future that will lay down the roadmap for tapping alternate sources of energy. India is now viewed as a global leader in climate change through its concerted efforts and commitment towards slowing down global warming. India has an advantage here due to its geographical location, climate conditions and abundance of renewable sources of energy like solar, wind and hydro making it ideal for becoming the world's cheapest hub for Hydrogen by 2050. Some of the leading companies that are pioneering the green hydrogen revolution in India include Reliance Industries, GAIL, NTPC, Indian Oil Corporation and L&T.

Further, refineries, fertilizer, and the steel industry are major consumers of hydrogen in the country. Apart from industries, active research, development, and demonstration is being carried out in the area of electricity production, hydrogen storage, and mobility (fuel cell powered cars, rail, truck, bus, ships). India has the potential to bring down the cost of green hydrogen by using low-cost renewable generating plants and cost-curtailment experience gained through solar and wind reverse auctions. Huge market potential, owing to the young demography and thriving economy, will be a long-term benefit for the government while pushing the application of hydrogen-based technologies.

Hydrogen sector needs many levers to create an ecosystem from early adoption of Hydrogen as energy source and later replacement of conventional to reduce dependence on fossil fuel. For instance, investments required for scaling up the Hydrogen value chain depends on the bankability which in turn depends on market availability and offtake assurance. Market development, on the other hand depends on price competitiveness of the product. Price competitiveness in turn depends on economies of scale. This chicken-and-egg conundrum can be solved only through a concurrent development of hydrogen supply, infrastructure and demand. Infrastructure development may leverage the synergies within hydrogen pathways with natural gas supply chain. Demand can be ramped up through government mandates, bilateral trade agreements, Hydrogen clusters and transport fleets. While sectors such as refining, ammonia etc. can immediately start consuming hydrogen, others such as steel may need a few more years. Investments in R&D may be required in order to accelerate adoption of hydrogen in sectors with lower technology readiness levels but high potential markets. Sectors needs to be prioritized on the basis of urgency of decarbonisation, technological and commercial readiness, and the costs associated to develop supply infrastructure. At the same time, health and safety of workers across supply chain should be of top priority with standardized training protocols, protective gears and insurance coverage.

[49] https://www.livemint.com/industry/energy/five-indian-companies-leading-the-green-hydrogen-revolution-11636369476063.html

INVESTMENT IDEA 9

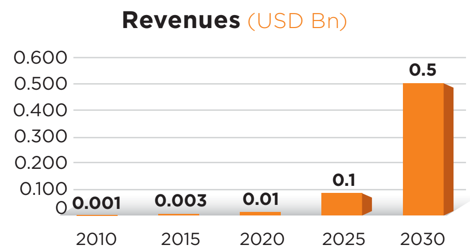
Green Gas Grid

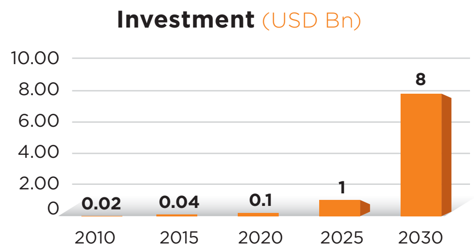
A green gas grid utilizes green gas as fuel for electricity production. The term ‘green gas’ include biomethane, green hydrogen and synthetic gas based on renewable electricity. In countries with well-established and closely linked gas grids, there are good opportunities to create a market for green gas, which lowers dependency on fossil fuels. Feeding green gas into the gas grid should be considered a priority, as its transmission and storage serve to ensure security of supply in the gas and electricity sector, reduce emissions in the transport sector and supply heat to densely populated urban areas.

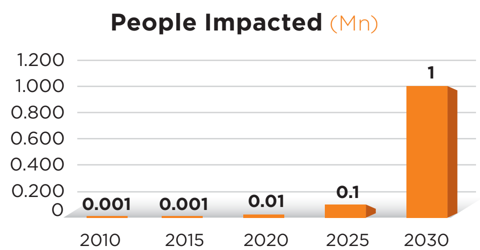
To implement the Paris Climate Agreement, there has been a thrust on increasing investments in renewable energy sources for the production of clean, green and affordable electricity.

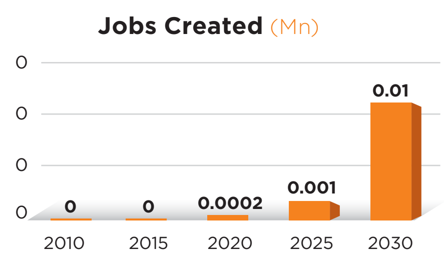
In European countries, support schemes for “green gas” have been introduced such as the Renewable Energy Sources Act in 2004 and Green Electricity Act 2002, to promote injection of green gas capacity into the gas grid. National laws and regulations have had a considerable influence on these expansion rates. Several countries are relying on the production of biomethane for electricity production. In Germany, Great Britain, France, and Sweden, biomethane injection plants produced 23 TWh in 2018. Further, national laws and ordinances have established systems that guarantee fixed feed-in tariffs or feed-in premiums or allocate tradable certificates to the operators of renewable electricity generation plants.

Currently, the following business models are prevalent:









1. Energy-as-a-service, where upfront capital investment, management of energy usage to deliver the desired energy service are borne by the energy service provider.
2. Investor-owned DSOs (Days Sales Outstanding), where both regulated and unregulated business costs (e.g., energy services, pipeline construction, transmission/distribution) are borne by investors.[50]
3. Cross-border trading, which include trading of injected biomethane that represents the “green”value of energy produced from biogas, a renewable energy source. The green value of the upgraded biogas may be traded commercially as digital certificates among the member registries.
4. Computable general equilibrium model as part of the incentive-based model for green gas where incentives are provided by the government for installation and production of green gas.

Countries have started to set targets for implementing legal frameworks like the Renewable Energy Acts. In Germany, 170 biomethane plants feed about 5,600 GWh into the German gas grid. From 2012, France has set up green gas injection units with a total annual capacity of almost 280 GWh. In upcoming years, it is planning to add 150 projects with an annual capacity of 3500 GWh.[51] Gas transmission system operators (TSO) of the Green Gas Initiative (GGI) have signed a joint declaration and committed to contributing to a CO2-neutral gas supply by 2050. Currently 355 biomethane plants inject 11 TWh into the gas networks that supply energy to 740,000 homes cutting CO2 emissions of approximately 3.5 million tonnes.[52]

In 2011, around 854 million people in India used 216.4 million tonnes of biomass which translated to release of 320 million tonnes of CO2 annually. If all the biomass came from scrub forests then traditional cookstoves are denuding scrub forests at the rate of 2.54 million ha per year.[53] Realizing this, the Government of India launched the National Policy on Biofuels 2018, with an aim to increase the use of biofuels in energy and transportation.

Oil companies have undertaken various biofuel projects in the country including compressed biogas projects under the SATAT (Sustainable Alternative towards Affordable Transportation) initiative which envisages target production of 15 million metric tons of Compressed Biogas (CBG) by 2023-24, from 5,000 CBG Plants. HPCL released letters of intent for setting up 100 new CBG plants with a capacity of 635 tonnes per day, taking cumulative letters of intent to 151 with a capacity of 841 tonnes per day.[54]

Injecting gas into the grid has technical, economical, and systems-level challenges. Green gas is not a viable fuel for all climate conditions and inter-seasonal variability. Gas leakages pose safety issues and green gas use still has climate pollution concerns unlike renewable sources such as wind and solar energy.[55] Green gas systems would require building mostly new production infrastructure, since green gas comes from different sources than does fossil natural gas. Such investments are both long-term commitments and opportunity costs. They require a massive initial investment, and policy and regulatory support.[56] Injecting green gas into grid projects is yet to reach commercial scale, and economic studies indicate that these projects require electricity balancing markets or government support through taxes or subsidies.

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[50] https://www.rolandberger.com/en/Insights/Publications/Green-Gases-Perspectives-from-Europe-and-the-US.html

[51] https://www.ifri.org/sites/default/files/atoms/files/mathieu_eyl-mazzega_biomethane_2019.pdf

[52] https://www.greengasinitiative.eu/upload/contenu/ggi-biomethane_report_062017_1.pdf

[53] https://www.un.org/esa/forests/wp-content/uploads/2018/05/UNFF13_Background_Note_Wood_Energy_in_IndiaTERI.pdf

[54] https://www.hindustanpetroleum.com/SATAT

[55] https://www.eia.gov/environment/emissions/carbon/

[56] https://theconversation.com/renewable-natural-gas-may-sound-green-but-its-not-an-antidote-for-climate-change-138791

INVESTMENT IDEA 10

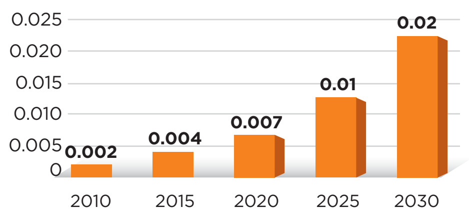
Carbon Recycling

Carbon Recycling is a concept of focusing on utilization of CO_2 as raw material, in order to contribute to the energy security issues as well as climate change problems. Considering carbon dioxide (CO_2) as source for carbon, CO_2 needs to be captured and then utilized and recycled as carbon compounds. The idea of capturing carbon dioxide (CO_2) from coal power plants or oil facilities and storing it underground has got significant attention. Along with testing underway through various pilot projects, research is being done on the technology to absorb carbon dioxide directly out of the air to make hydrocarbons, instead of out of coal plant flue gas.

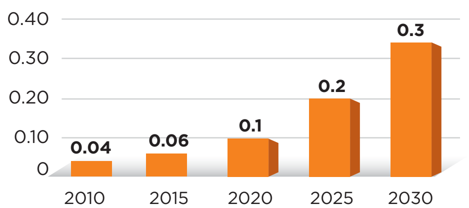
"Upcycling" carbon emissions to create consumer product offers a potential USD 1 trillion annual market in the United States alone. While Europe dominates the global recycled carbon market on the back of growing investments in the development of advanced composite technology solutions, increased awareness and use of eco-friendly products, enhanced usage of composites in construction, automotive and wind energy sectors, etc. Asia Pacific market is forecasted to be witnessing the highest growth rate over the next decade on account of improving economic conditions and rapid industrialization in developing economies especially India and China.[57]

The establishment of climate policies is offering incentives to promote the continued research and development of carbon capture and utilisation methods may fast-track the achievement of Sustainable Development Goals compared to current policies based on penalties and taxation, which may inherently be limiting R&D efforts by reducing available funding. Innovative solutions to address climate change are using carbon dioxide to develop plastic, soap and fabric. But such industries are still nascent and need to come up across the globe to adopt carbon recycling on a wider scale.

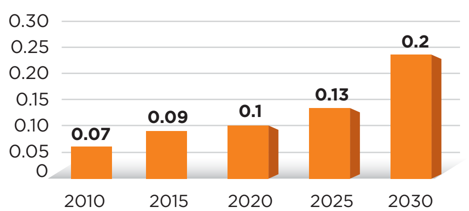
Revenues (USD Bn)



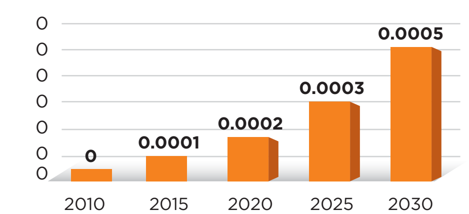
Investment (USD Bn)



People Impacted (Mn)



Jobs Created (Mn)



Some sectors that emit substantial quantities of CO_2 - such as cement and transportation are not easily able to use sustainable alternatives. The process of carbon capture, utilization and storage (CCUS) provides an appealing method to lower emissions from these sources by capturing the CO_2 emitted before it enters the atmosphere. Following its capture, the carbon is often stored underground, but new tactics aim to use it to produce a variety of products such as fertilizer, plastics and, recently, 'clean' fuel. This can be seen as a circular carbon economy, where currently taxed carbon emissions can instead be captured and turned into valuable commodities. Producing ethanol from carbon dioxide captured from vehicle or power plant exhausts holds the potential for a carbon-negative process that effectively converts carbon emissions into a valuable commodity, which is fuel.

Japan's Ministry of Economy, Trade and Industry had released a Roadmap for Carbon Recycling Technologies in 2019. It outlines three stages involving broad research with a focus on technologies that do not require hydrogen input, reducing cost of technologies and deployment by 2030 and identifying new technologies ready for deployment by 2050.[58] Since the industrial revolution, human activity has increased atmospheric carbon dioxide by 47 percent. Carbon Recycling International is producing liquid fuel at industrial scale from CO_2. In the United Kingdom, Air Fuel Synthesis aims to use atmospheric CO_2 and wind energy to produce aviation fuels in a concept demonstration at an initial rate of 1 litre (about one-quarter gallon) per day. In December 2020, six Japanese companies have signed an agreement to begin reviewing recycling business models for reuse of CO_2 from sources such as exhaust gases into Sustainable Aviation Fuel via Power-to-Chemicals processes, using technologies developed by Toshiba Corporate Research & Development Center which convert carbon dioxide (CO_2) to carbon monoxide (CO) through electrolysis.

India is the third largest emitter of CO_2 in the world producing about 2.65 billion metric tonnes of CO_2 in 2018 while contributing to around 7 percent of the global CO_2 emissions.[59] At the United Nations Climate Change Conference of the Parties (COP 26), India has committed to become carbon neutral by 2070. Various conglomerates including corporates, railways etc. are committing to become carbon neutral and net carbon zero by 2030 or 2040. Hence, carbon capture, utilization and storage (CCUS) and further carbon recycling will be the key consideration to help them achieve their committed targets. Plastics, chemicals, cosmetics and many other products need a carbon source. If we could produce them using carbon dioxide instead of fossil hydrocarbons, we would be able to sequester billions of tonnes of greenhouse gases per year.

Carbon capture and recycling has been considered as a panacea to fossil fuels in India. There is a need to regulate the volume of carbon emissions depending on the size and scale of operations. Moreover, the process of carbon recycling is quite expensive. Economy of scale and incentivization has the potential to make carbon recycling an affordable process. Secondly, the long term effect of carbon storage is still under observation and there is a need to invent prudent solutions to avoid any long term challenges.

[57] https://www.researchnester.com/reports/recycled-carbon-market/3443
[58] https://www.iea.org/policies/11679-roadmap-for-carbon-recycling-technologies
[59] https://www.bbc.com/news/world-asia-india-58922398

100 Startups & Investors

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 1 **Electric Mobility**	**Startup**: PURE (2015) **Investors**: IIT Hyderabad **Startup**: Okinawa Scooters (2015) **Investors**: Hindustan Media Ventures **Startup**: Simple Energy (2019) **Investors**: Sattva Group, Athiya Developers, 1Digi Investment Management, Atiyas Electric, Vasavi Green Tech, Atiyas Craft **Startup**: Batt:RE (2017) **Investors**: Sangam **Startup**: EeVe (2018) **Investors**: Unfunded **Startup**: BGauss (2019) **Investors**: Unfunded **Startup**: Gemopai (2016) **Investors**: Unfunded **Startup**: TresMoto (2016) **Investors**: Shell E4		**Startup**: Ola Electric (2017) **Investors**: Falcon Edge Capital, Alpha Wave Investors, SoftBank, Tiger Global Management, Matrix Partners India		**Startup**: Ather Energy (2013) **Investors**: Hero MotoCorp, Tiger Global Management, Innoven Capital, IITM Incubation Cell

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 2 **Consumer Centric Cleantech**	**Startup**: AirOK Technologies (2014) **Investors**: Precog Innovation, IITM Incubation Cell, Ncubate Capital Partners, NK Investment Group **Startup**: Skilancer Solar (2017) **Investors**: Venture Catalysts, ALFA VENTURES, Italica, Ferron Tubes **Startup**: Orxa Energies (2015) **Investors**: GAIL **Startup**: Winnerspitch Energy (2014) **Investors**: Unfunded **Startup**: Oorjan (2014) **Investors**: Hercules Pigments, Globevestor **Startup**: ThingsCloud (2014) **Investors**: AIRI Capital, CoE IoT, Revvx **Startup**: Iyert Energy (2012) **Investors**: Unfunded	**Startup**: Log9 Materials (2014) **Investors**: PETRONAS, Belltower Fund Group, Sea Frontier Fund Llp, Amara Raja Group, Exfinity Venture Partners **Startup**: Karma Recycling (2013) **Investors**: Infuse Ventures, The Low Carbon Enterprise Fund **Startup**: Freyr Energy (2014) **Investors**: C4D Partners, Schneider Electric, DOEN Foundation, Total Carbon Neutrality Ventures			

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 3 **Green bonds**	**Issuer**: State Bank of India (Mar 2020) **Amount**: USD 100mn **Sector**: Energy				
	Issuer: ReNew Power (Jan 2020) **Amount**: USD 450mn **Sector**: Energy				
	Issuer: Adani Green Energy (Oct 2019) **Amount**: USD 362mn **Sector**: Energy				
	Issuer: Azure Power (Sep 2019) **Amount**: USD 350mn **Sector**: Energy				
	Issuer: Greenko (Jul 2019) **Amount**: USD 950mn **Sector**: Energy				
	Issuer: Indian Railway Finance Corporation (Dec 2017) **Amount**: USD 500mn **Sector**: Transportation				
	Issuer: Power Finance Corporation (Dec 2017) **Amount**: USD 400mn **Sector**: Energy				
	Issuer: Rural Electrification Corporation (Jul 2017) **Amount**: USD 450mn **Sector**: Energy				
	Issuer: Axis Bank (Jun 2016) **Amount**: USD 500mn **Sector**: Energy, Buildings and Transport				
	Issuer: IDBI Bank (Nov 2015) **Amount**: USD 350mn **Sector**: Energy, Transport and Water Management				

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 4 **Utility-Scale Solar**	**Startup**: O2 Power (2019) **Investors**: EQT				
	Startup: Praaditya (2021) **Investors**: Unfunded				
	Startup: Eastern Powers (2010) **Investors**: Unfunded				
	Startup: Sgurr Energy (2002) **Investors**: Unfunded				
	Startup: Coslight (2007) **Investors**: Unfunded				
	Startup: Solarwale (2016) **Investors**: Unfunded				
	Startup: Shreesha Energy Solutions (2018) **Investors**: Unfunded				
	Startup: ceNdor Industry (2020) **Investors**: Unfunded				
	Startup: Aumsun Solar (2019) **Investors**: Unfunded				
	Startup: Ainesh Renewable (2020) **Investors**: EQT				

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 5 **Microgrid**	**Startup**: Gram Power (2010) **Investors**: Village Capital, USAID **Startup**: Gram Oorja Solutions (2008) **Investors**: Polyhydron, Millennium Alliance, RiverBridge **Startup**: Onergy (2009) **Investors**: DOEN Foundation, CIIE, SIDBI, Villgro, Caspian, Artha Impact **Startup**: UNPC India (2018) **Investors**: Unfunded **Startup**: Efligence (2018) **Investors**: Unfunded **Startup**: EnTruist Power (2018) **Investors**: Unfunded	**Startup**: Cygni Energy (2014) **Investors**: IndusInd Bank, Endiya Partners, RTBI **Startup**: Selco (1994) **Investors**: DOEN Foundation, Good Energies, Lemelson Foundation, Eandco	**Startup**: OMC Power (2011) **Investors**: Aurum Ventures, Mitsui & Co, The Rockefeller Foundation	**Startup**: Husk Power (2008) **Investors**: Shell Technology Ventures, Swedfund, Engie, LGT Impact Ventures	
INVESTMENT IDEA 6 **Energy-as-a-Service**	**Startup**: Emflux Motors (2016) **Investors**: IKP EDEN, Jcurve **Startup**: Esmito (2018) **Investors**: IITM Incubation Cell **Startup**: Enercent (2018) **Investors**: Unfunded **Startup**: Adinan Global Energy Solutions (2018) **Investors**: Unfunded **Startup**: KPay Innovation (2018) **Investors**: Unfunded **Startup**: Energeia (2017) **Investors**: Unfunded **Startup**: Grinntech Motors & Services (2011) **Investors**: RTBI, IITM Incubation Cell	**Startup**: SUN Mobility (2017) **Investors**: Bosch, Vitol **Startup**: Lohum (2011) **Investors**: Baring Private Equity Partners India, QH Talbros, Talbros Automotive Components, QH Talbros, Sprout Invest	**Startup**: Ultraviolette (2014) **Investors**: TVS Motor Company, GoFrugal Technologies, Speciale Invest		

Investment Idea	Startups- Investment Stage/ Last Funding Type				
	Angel/Seed	Series A	Series B	Series C	Series D+
INVESTMENT IDEA 7 **Peer 2 Peer (P2P) energy trading**	**Startup**: TroonDx (2019) **Investors**: Unfunded				
INVESTMENT IDEA 8 **Green Hydrogen**	**Startup**: h2e Power Systems (2011) **Investors**: SINE **Startup**: Ohmium International (2019) **Investors**: Unfunded				
INVESTMENT IDEA 9 **Green Gas Grid**	NA				
INVESTMENT IDEA 10 **Carbon Recycling**	**Startup**: String Bio (2013) **Investors**: Zenfold, Redstart, MantriCa, Ankur Capital, ONGC, Seventure Partners **Startup**: Carbon Craft design (2016) **Investors**: ClimateLaunchpad **Startup**: Breathe Applied Sciences (2016) **Investors**: DST Nano Mission **Startup**: Kinc Mineral Technologies Pvt. Ltd (2004) **Investors**: Unfunded				

Author Bios

Amit Bhatia, Founder & CEO, Aspire Impact & Aspire Circle

Amit Bhatia (www.amitb.in), is the Founder of Aspire Impact & Aspire Circle, was formerly Inaugural CEO of G7's Global Steering Group for Impact Investment (2017-20); Founding CEO of India's Impact Investors Council (2014-2017); Founding CEO of WNS Knowledge Services; and Founder of McKinsey Knowledge Centre.

Adwait Joshi, CEO, CLEAN

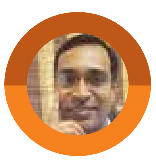
Adwait Joshi is the CEO of CLEAN, an industry accelerator of decentralized renewable energy organizations in India, committed to advance clean energy integration for sustainable development in underserved communities.

Amarjeet Singh, Partner, KPMG

Amarjeet Singh is a Senior International Tax and Regulatory Partner with KPMG in India specializing in the area of internet commerce and start-ups in the Fintech space. He is a qualified Chartered Accountant and has advised a number of Corporates in relation to inbound and outbound investments from India.

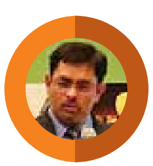
Amit Kumar, Partner, PwC

Amit Kumar has over 30 years of industry experience with expertise in clean energy sector. He has helped several public and private clients with deals and acquisitions for their proposed investments in renewable energy. He has led the team in formulating 100 GW solar energy scale up plan for India with MNRE. He carries strong expertise in policy and regulatory framework in the clean energy domain. Amit has worked with various private sector clients across the RE value chain in B-Plan preparation and strategic roadmap.



Amit Raje, Chairman & MD, Aartech Solonics

Amit Raje is a 2nd Generation Entrepreneur with a focus on facilitating innovations & business initiatives in selected & specialized energy applications at Aartech Solonics Limited, a 30+ year old BSE-SME listed enterprise, as its Managing Director & Chairman of its Board of Directors. He also serves as an executive member of the directorial board in Central India as the Chief Mentor of AIC- Aartech Solonics Pvt. Ltd., an Atal Incubation Centre supported by Atal Innovation Mission, NITI AAYOG.

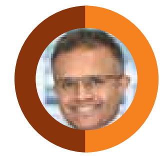


Ashish Mehta, Founder & MD, Second Nature

Managing Partner at Second Nature, and Co-Founding Partner at MinusCO2, Ashish Mehta is focused on leveraging the impact ecosystem with scalable and distributed urban clean-tech solutions. Prior to this, he has had a 20+ year corporate experience spanning engineering, capital markets, and consumer retail.

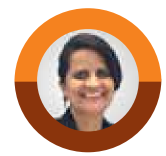
V S Hariharan, Co-Founder, Third Wave Power

Hariharan V S is the CEO of Third Wave Power, a company that develops innovative affordable solar power solutions for off grid consumers. He has more than 30 years of General Management, Product Marketing and Channel Sales experience working at Hewlett-Packard and Wipro Infotech.



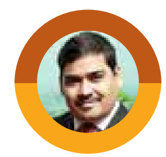
James Abraham, Founder & Director, SolarArise

James Abraham is the Co-Founder and Director of SolarArise, an Independent Power Producer focused on solar-powered assets. He has been working for over a decade to make renewable energy viable and scalable in India. He is a member of the India-US and India-UK Dialogues one Climate Change.



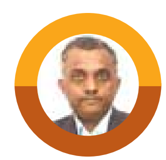
Jamuna Rao Verghese, Managing Partner, Dancing Rain Capital

Jamuna Rao Verghese is the Founder and Managing Partner for Dancing Rain Capital, a Singapore based Impact Investment Advisory firm. Prior to this, she started and led the Impact Investments and Inclusive Markets practise at PwC India and was earlier funding debt and equity at Citibank, ANZ and a Fund.



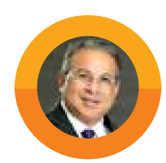
Jitendra Routray, Head-CSR, ReNew Power

Jitendra Routray is the CSR- Head, ReNew Power, one of India's leading renewable energy company. His previous professional associations have been with civil society organizations like Care India, Help Age India, Development Alternatives, and ANaRDe Foundation. Prior to ReNew Power Jitendra was working with TATA Teleservices Limited as Lead CSR and Affirmative Action.



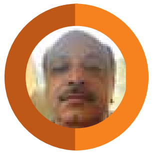
Mayank Choudhary, Head-Private Sector Infrastructure Finance, ADB

Mayank Chaudhary is with the Private Sector Operations Department at the Asian Development Bank and is the Unit Head, Infrastructure Financing for South Asia. Mayank has over twenty years of corporate finance, investment banking, private equity and project finance experience and deep domain knowledge in the energy and infrastructure sectors. Prior to ADB, he has worked at Macquarie Capital, SUN-Apollo Real Estate, International Finance Corporation (IFC) and Chevron Corporation. He has an MBA degree from the Indian Institute of Management (Ahmedabad).



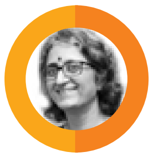
Dr. Praveer Sinha, CEO & MD, Tata Power

Dr. Praveer Sinha, is the CEO & Managing Director of The Tata Power Company Limited (TPC, Mumbai), India's largest integrated power company. Dr. Sinha has nearly 36 years of experience in Power Generation and Distribution sector in India. Prior to his present role, he had served as the CEO & MD of Tata Power Delhi Distribution Limited (TPDDL), a Public Private Partnership with Delhi Government.



Rajeev Kumar, VP & Director, BP India

Rajeev Kumar is the Vice President, Business Development & Integration, RC&S in bp. He heads business development for integrated energy solutions for cities and corporations in India. He is part of Country's leadership team and has been involved in bp's growth in gas and retail business. He has been with bp for over 14 years and prior to which he was working with National Oil Company, Oil India Limited, for over 22 years.

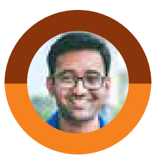


Rekha Krishnan, Founder, WEFT

Rekha Krishnan is an economist with over 25 years' experience in policy research on sustainable energy, energy access, energy pricing, decentralised renewable energy, clean cooking energy access & water inequities. Rekha worked with TERI (The Energy & Resources Institute) for over 10 years in various roles. She worked with a group of Ashden award-winning enterprises to lead their policy research activities.

Svati Bhogle, Founder, Sustaintech India

Svati Bhogle has played a crucial role in shaping the space around sustainable technology innovation and dissemination, grassroots entrepreneurship models and associated policy initiatives. She is the President of Clean Energy Access Network. She has studied Chemical Engineering and is an alumnus of IIT Bombay.



Tarun Mehta, Co-Founder & CEO, Ather Energy

Tarun Mehta co-founded Ather Energy in 2013 & serves as its CEO. Tarun was actively involved with the entrepreneurship eco-system in IIT Madras (C-TIDES). A strong believer in the superiority of the electric drive, he started working on EV battery packs to solve one of the biggest pain points with EVs in India.

ACKNOWLEDGEMENTS: SPONSORS

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Clean Energy Access Network

ACKNOWLEDGEMENTS: GUEST CONTRIBUTORS

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Deepali Khanna- MD Asia Region Office, Rockefeller Foundation

Rajeev Kher- Founder & MD, Saraplast

Saachi Singla- Manager, PwC

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Neha Gupt- Director, IFP

Pallavi Khanna- Director, Aspire Circle

Prakhar Agarwal- Director, Knowledge Development

Ravi Kumar- Manager, IFP

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ASPIRE™

Aspire, founded by Amit Bhatia, focuses on impact leadership and ecosystem development through three initiatives: Aspire Education (www.aspireeducation.in) for education, Aspire Impact (www.aspireimpact.in) for ecosystems, and Aspire Circle (www.aspirecircle.org) for social leadership. Aspire, established in 2007, based in Gurgaon (India) is committed to making Impact a way of life.

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