DRE and its downstream applications offer an opportunity to not only meet India's climate and renewable energy targets but also provide attractive returns to financial investors.

Over the last few years an increasing number of smaller RTS and OGS companies have been able to better develop their business models and are now in need of growth-stage funding. However, many smaller RTS and OGS developers still lack the required capabilities to navigate the entire credit appraisal process of lenders. This lack of expertise also reduces their probability of reaching financial close. For such developers, there is increasing demand and need for additional rounds of early-stage capital, technical assistance, and strategic advice to move towards commercialization and to attract growth equity.

Information asymmetry, due to lack of project preparation and targeted transaction advisory, is also a significant cause of lack of access to capital for smaller DRE developers. Government and philanthropic support should be channeled to quickly address these gaps, allowing the DRE sector to scale more rapidly.

On the private capital side, though impact investors have scaled up their DRE operations over the last decade, participation among private capital owners such as family offices, high net-worth individuals, and corporates remains limited. With competing demands for capital from mainstream business models, such investors view DRE as less financially attractive. Blended finance instruments can potentially help to bridge this gap.

Even with the positive intent of impact investors, currently impact investors, along with commercial financial investors active in the space, tend to favor mature-stage companies and projects. An opportunity exists to create incentives and expand investment focus to finance smaller and emerging companies in niche segments that have the potential to scale over the next few years.

DRE and its downstream applications offer an opportunity to not only meet India's climate and renewable energy targets, but also provide attractive returns to financial investors. DRE also paves the way for India to reduce import-dependence on crude oil, in turn accelerating economic growth and jobs in the long run. Addressing the existing policy and financing gaps identified in this report through a combination of policy advocacy, knowledge dissemination, and catalytic finance would not only allow for better targeting and risk-hedging of government spending programs, but would also allow capital to be recycled efficiently, thereby enhancing both the duration and magnitude of the impact.

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1. CONTEXT

India is the world's third largest carbon emitter, with emissions expected to rise as the economy grows. While this economic growth is important for advancing development objectives, especially in the wake of a likely recession due to the COVID-19 pandemic, it also poses a challenge as around 600 million people in India are at risk from the impacts of climate change such as floods, wildfires, and heat waves. Additionally, inaction on this threat could shave USD 1.12 trillion off the country's GDP by 2050,[2] eroding progress on sustainable development and poverty alleviation in a country that already struggles with meeting basic needs.

Recognizing these various needs and challenges, India has rightly targeted its energy sector for transformation, with an ambitious target of 175 GW of renewable energy by 2022. Solar energy comprises 100 GW of this target, of which 40 GW will be rooftop solar (including small-scale grid connected solar projects).

Between 2015-17, there was significant uptake in renewable energy capacity addition, which could be attributed to the falling costs of renewable energy technology and favorable policy measures by the government. Since 2017, the capacity additions have been somewhat slower given the slowing economy as well as the introduction of tariff caps for large scale renewable energy. As of March 31, 2020, with installations of 32 GW, the utility-scale solar installations are well behind their target of 60 GW. In addition, with installations of 5.25 GW, the RTS installations are only at ~13% of their 40 GW target.[3]

The retail electricity market in India is structured in a way that the rural and agricultural customers pay the lowest price for power, but they also suffer the most from the intermittent and low-quality supply of power. This leads them to incur indirect effects such as low quality of life for households and low quality of output for farmers. This segment would benefit the most from downstream applications of off-grid solar. Targeted schemes, such as Kisan Suraksha Abhiyan Utthan Mahabhiyan (KUSUM) subsidy for installation of agricultural solar pumps, and Direct Benefit Transfer (DBT) of power subsidies directly to the people through their bank accounts, are designed to help alleviate losses for state electricity distribution companies (DISCOMs) as well as improve the competitiveness of the agricultural sector and the quality of life of rural households.

Due to this cross-subsidized model of power pricing, Commercial and Industrial (C&I) customers demonstrate the highest tendency to shift towards rooftop solar and would benefit the most from future downstream applications such as behind-the-meter energy storage.

Commercial and Industrial (C&I) customers consume only 51% of the power in India but pay the highest tariffs, are a major share of DISCOM income, and cross-subsidize rural and agricultural customers.

This report studies the market potential of DRE and its multiple downstream applications, their role in addressing government energy security goals, identifies policy and institutional challenges, and provides recommendations to fill the identified gaps.

2. MARKET POTENTIAL

The potential of distributed renewable energy in India is huge. In this section, we outline the sub-segments that have the highest growth potential for meeting government targets for sustainable energy security in the coming years but have fallen short so far on this front.

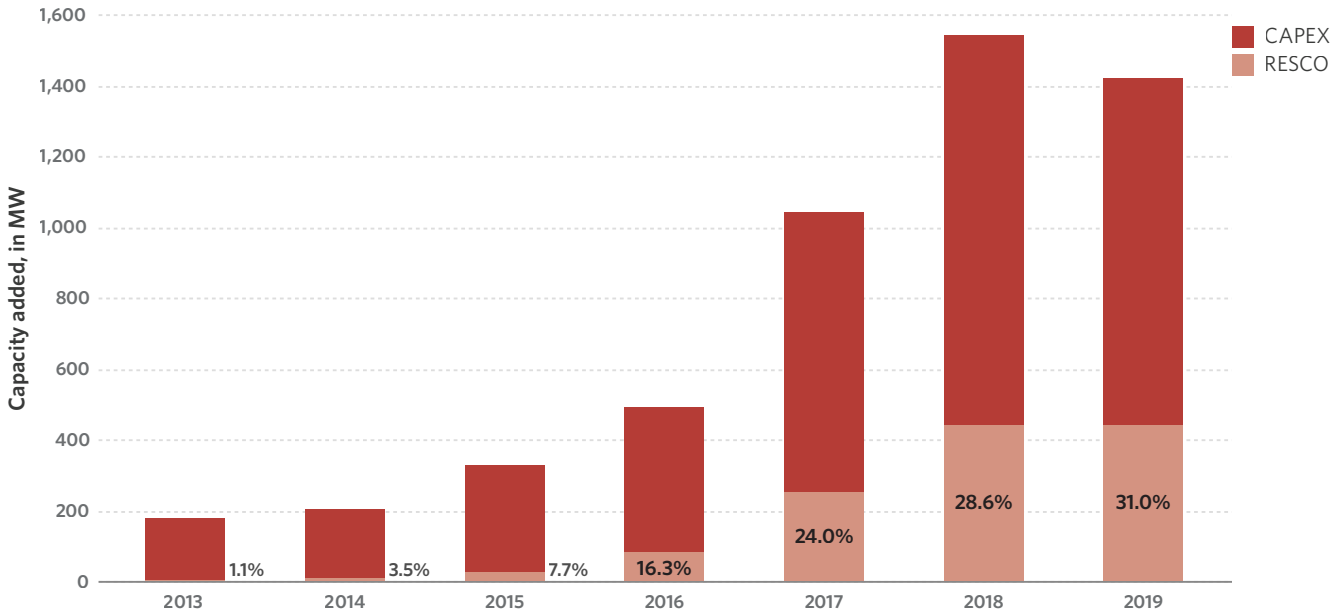
2.1 ROOFTOP SOLAR

Adoption of rooftop solar by several small and medium industries can play a key role in decarbonizing India's manufacturing supply chain.

In addition, given the high cost of electricity and deteriorating air quality in cities, rooftop solar is increasingly being considered as a replacement for diesel generator sets in residential and commercial segments.

Despite the potential for capacity installation, mitigation, and developmental impact, and the potential investment opportunities in emerging business models, the growth of rooftop solar in India is constrained due to lack of access to institutional finance - both debt and equity. An estimated total investment of USD 25-30 billion is required to achieve the 40 GW rooftop solar target.[4] **Moreover, as the current installed capacity of rooftop solar is only 5.25 GW, India will require a compound annual growth rate of over ~100% (or more than double the addition to capacity every year) to reach this target.**[5]

Figure 1: Annual capacity addition

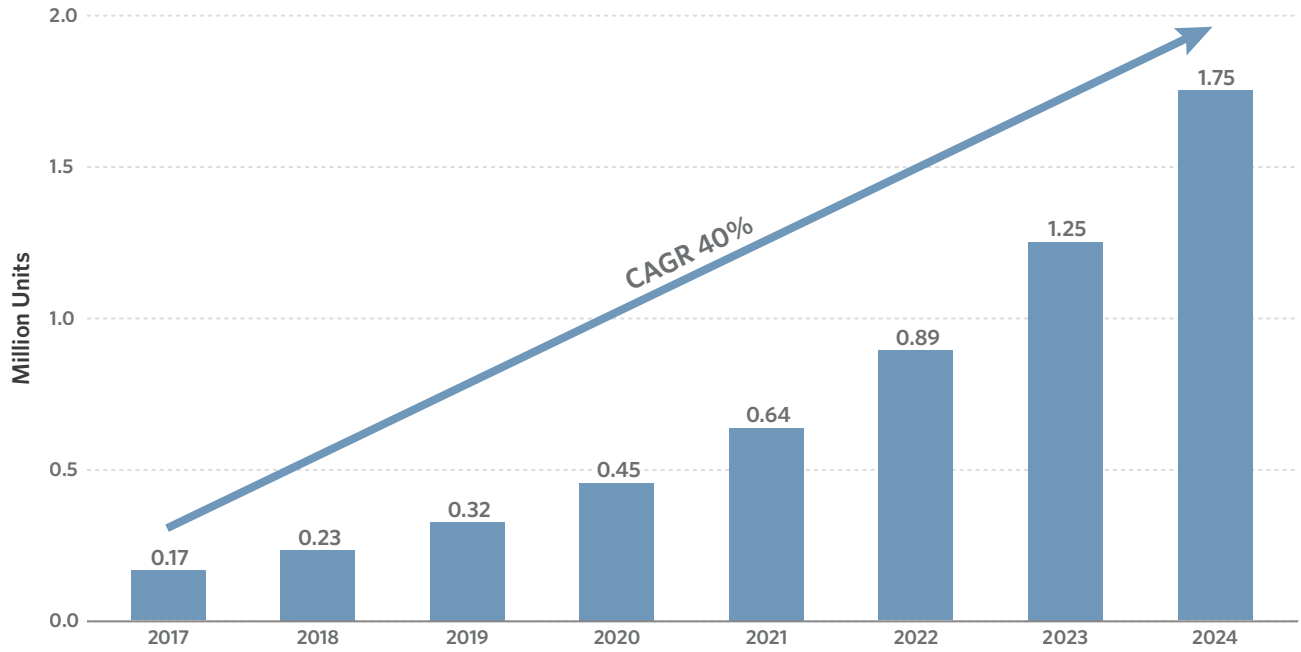


Source: Bridge to India

2.2 SOLAR AGRI-PUMPS

India has traditionally been an agricultural economy with over 160 million households dependent on agriculture for livelihood.[6] Access to reliable water remains a challenge as only ~50% of the agricultural land in India is currently under irrigation.[7] This presents a unique market opportunity to provide solar-based irrigation solutions to around 80 million households in India. The Government of India (GoI), under its KUSUM scheme, has targeted a cumulative installed capacity of 1.75 million solar water pumps (around 6% of the total agricultural pumps in the country) by 2024.[8] At the current average price of agricultural pumps of around INR 200,000 (USD 2,700), the estimated annual market size would be INR 10,000 crores (USD 1.5 Billion).

Figure 2: Solar water pump installed capacity



Source: GoI KUSUM Proposal and CPI research

2.3 SOLAR COLD STORAGE

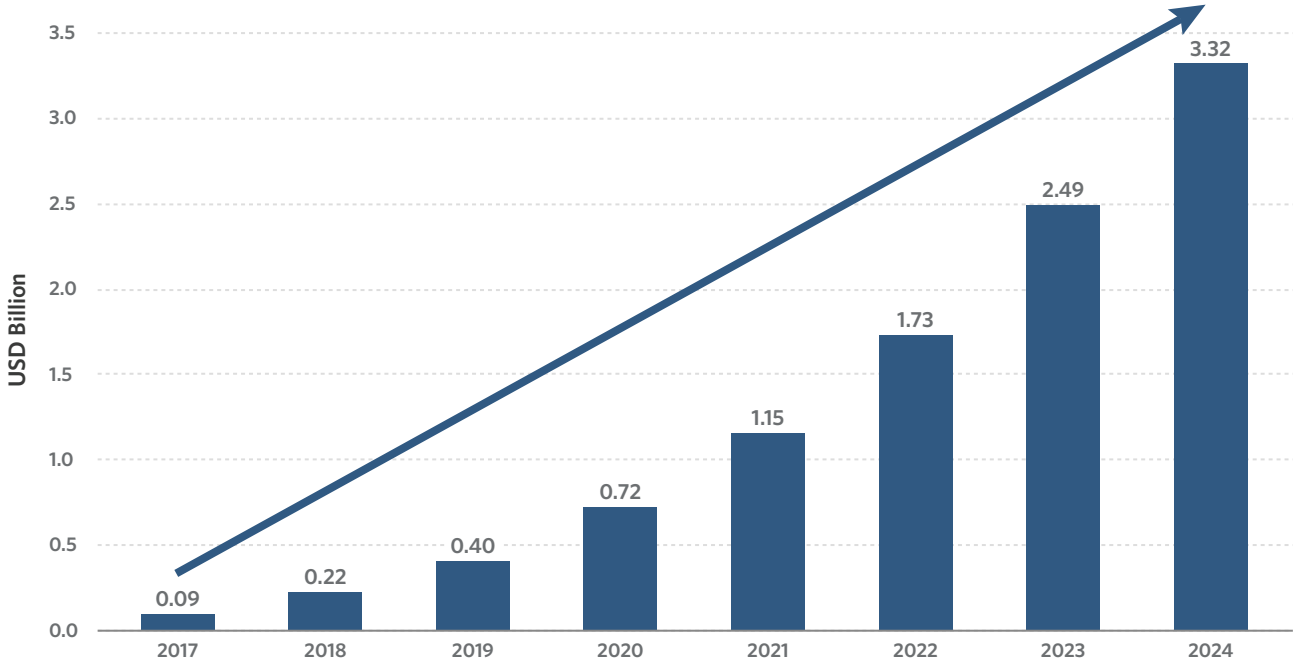
India's weak agriculture supply chain results in significant loss in agricultural produce, leading to loss in income for farmers. The government has set itself a target of doubling farm income by 2024, for which having a robust supply cold storage infrastructure is essential.

The cold chain industry in India was worth around USD 3.5 billion in 2017 and is expected to reach USD 9.5 billion by 2024.[9] Access to grid-based electricity has been a challenge for the rural population in India. This presents an opportunity for solar-based cold-storage solutions to penetrate the market. The GoI launched a nodal agency called National Center for Cold Chain Development (NCCD), which promotes a number of subsidy schemes for setting up

cold chain elements in India.[10] With an average connected load of 20-25 kW, cold storage offers a significant unaddressed potential for use of decentralized solar energy.

On a conservative basis, we estimate that over the next 7 years, the contribution of solar cold storage to the overall cold storage market will increase in a linear fashion from 1% to10%. This would translate into a market opportunity of USD 3.3 billion.

Figure 3: Solar cold storage market size

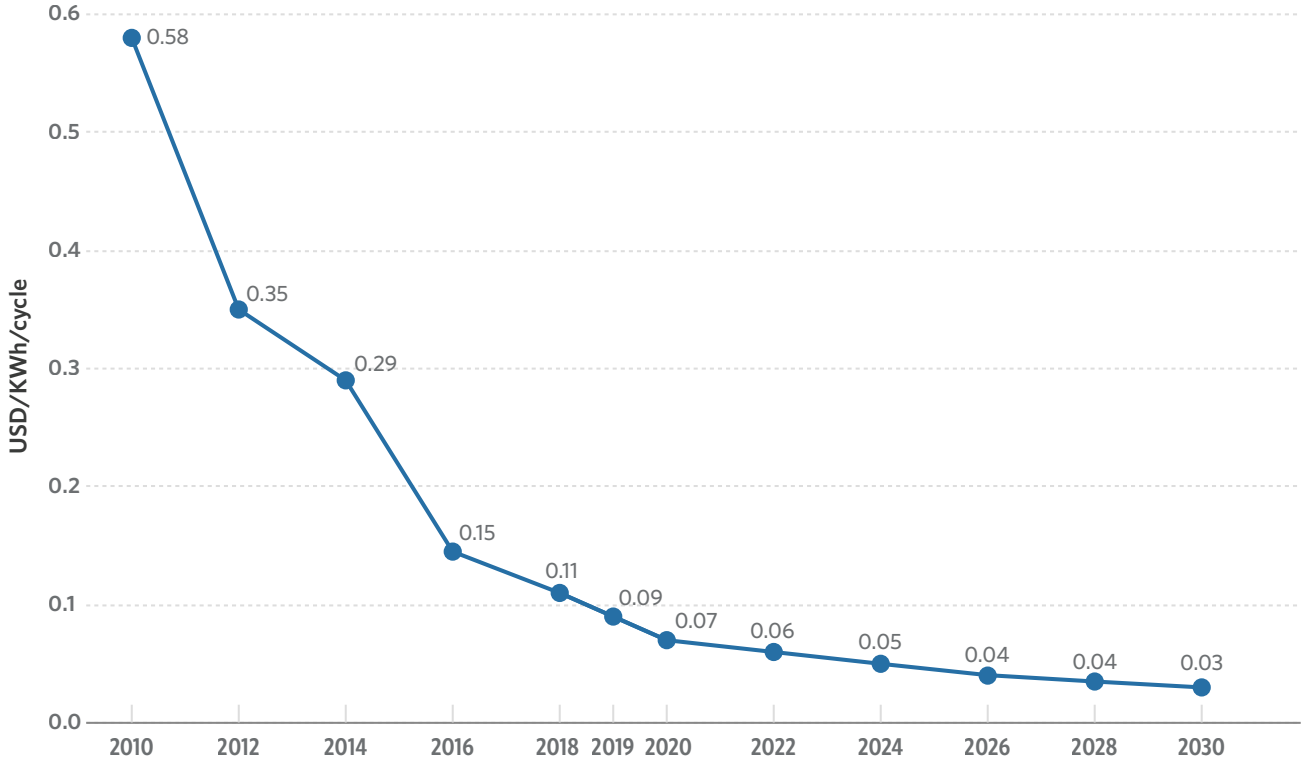


Source: CPI Research

2.4 DISTRIBUTED ENERGY STORAGE

Energy storage is a crucial tool for enabling the effective integration of renewable energy and unlocking the benefits of local generation and a clean, resilient energy supply. The technology is valuable to grid operators around the world who must manage the variable generation of solar and wind energy. However, the development of advanced energy storage systems (ESS) has been highly concentrated in select markets, primarily in developed economies.

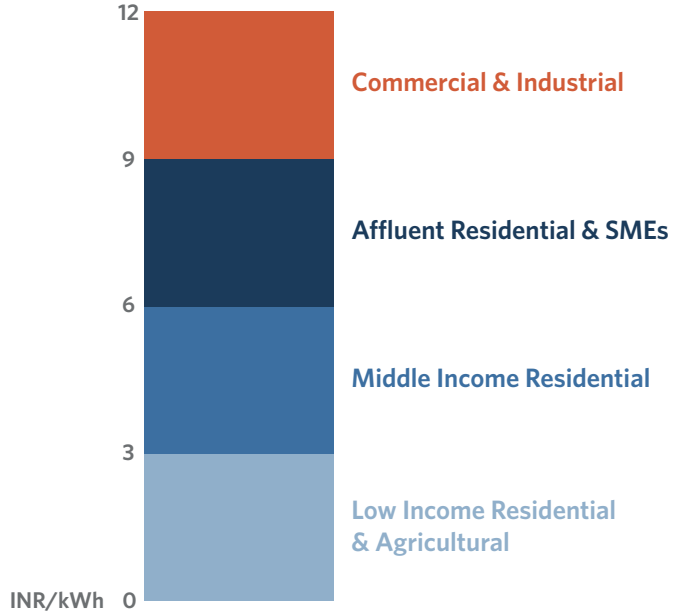
Figure 4: Lithium-ion battery costs



Source: Bloomberg New Energy Finance (BNEF)

In India, factors like operational inefficiencies in the state distribution system, cross-subsidization of agricultural and residential customers, and infrastructure development costs to support government schemes (such as rural electrification) have created a huge revenue gap for DISCOMs, leading to an increase in tariffs for commercial and industrial customers.

Figure 5: Tariff structure in India



Source: CPI Research