MYTRAH

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Renewable energy's transformation of the Indian electricity landscape

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Message from Mytrah

The renewable energy sector in India is growing rapidly and presents an opportunity for strong financial returns. Mytrah Energy Limited is listed in London and is one of the largest renewable energy producers in India today. We are pleased to present this paper, written in partnership with PwC India, which explains the Indian renewables sector and highlights some of the differences between it and the, perhaps better known, markets in Europe.

Having built a 560 MW operating portfolio over the last five years, Mytrah is benefitting from some of the key differences highlighted in this paper:

1. India is short of power, and thus, new renewable capacity produces electricity for an undersupplied market.
2. Renewable capacity is faster to market than alternatives such as coal-fired power.
3. Renewable electricity prices are similar to those of electricity from other sources.

In contrast to Europe, where renewables have generally displaced existing generation capacity and required heavy subsidies, India benefits from truly market-led renewable energy demand, without significant subsidy. Strong support from the Government of India reinforces the market fundamentals, creating a dynamic market which is growing rapidly. India already has 35 GW of renewable energy capacity and plans to grow this 500% over the next six years.

In our view, India is the most exciting power market in the world, particularly for renewables. With 400 MW in construction today and a pipeline exceeding 3,500 MW, we at Mytrah Energy Limited will continue to play a major role in the growth of renewable capacity. We hope that you will find this paper to be a useful and informative resource and will be pleased to engage in further discussion.

Ravi Kailas
Chairman and CEO
Mytrah Energy Limited

Foreword

India, now, has a golden opportunity to shape its energy mix. Social and economic growth are at the top of the government's agenda, and new energy sources to serve this demand are increasingly coming from renewable energy.

A number of factors have contributed to this. The government policy has been supportive, and more recently, a wider set of actions—incentives, infrastructure and investment promotions were taken up. Technology development, larger-scale projects and the learning effect has allowed the use of efficient designs and have pushed down costs. This makes renewable energy attractive to power utilities that are contracting new long-term capacity, and in addition, this avoids them the burden of take-or-pay contracts and fuel risk.

The dependence of renewable energy companies on fiscal support from the government is minimal in India. This means an investor with a given capital can fund more projects across regions or asset-classes to diversify resource-based risks. The lower cost structure also means that an investor who is early or better prepared gains from better returns.

At this stage, many challenges remain which are still being worked upon, viz. grid integration, curtailment, counterparty risk, cost of finance, imbalance costs, etc. Market creation has not been easy but regulators are acting on this with tighter compliance standards. Public opinion is positive with the recognition of environmental, economic and social benefits.

The resource potential of India is now recognised as substantially higher than earlier. Recent studies suggest that wind potential of 40-65 times higher is possible with new scale and technologies. Furthermore, new initiatives exploring offshore wind, provision of solar parks or construction of a transmission corridor for green energy can help support market development.

The considerations to meet energy demands, sustainability, energy security and lower costs are driving India's renewable energy growth. This is also a global story. The industry estimates that Europe will add 109 GW of renewables by 2020 while India aims to reach 175 GW (or add 140 GW) by 2022. This presents a compelling opportunity for developers and suppliers and is a major transformation opportunity for the electricity policy and for power markets.

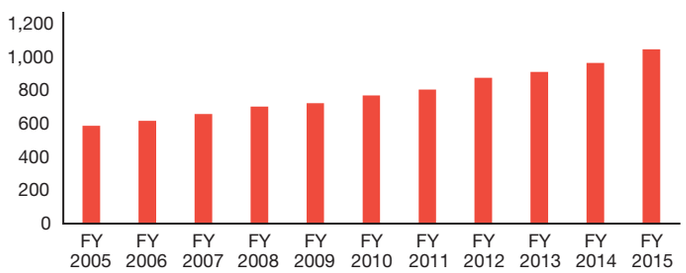
Kameswara Rao
Partner and Energy, Utilities & Mining Leader
PwC India

Transformation of the Indian electricity sector

Key developments and trends

The electricity sector in India is going through a period of significant growth and change. Among other aspects, the government is focussed on providing universal access and 24X7 supply. The primary fuel sector has been revamped with the auction of coal mines; energy efficiency in sectors across lighting to transport is being addressed; and a major attempt at transforming the energy mix—with a goal of 175 GW of renewable energy by 2022—is under way.

Electricity production in India (TWh)

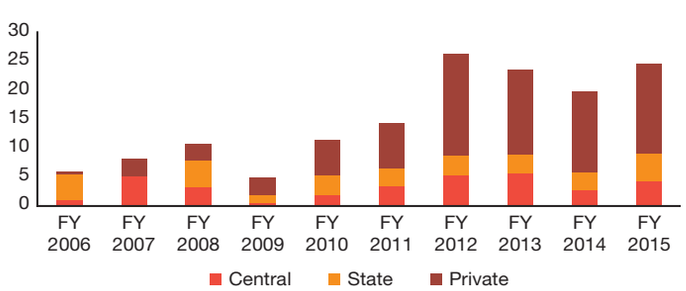


Source: CEA

Electricity production has crossed a landmark with 1,048 TWh (2014-15)—with a growth of 5.9% over the last decade (2005-15). India is now the third largest electricity producer in the world, just surpassing Japan and Russia. The generation capacity of 267 GW, which has grown at a rapid 11% in the last five years, makes India the fourth largest electricity market in the world. Furthermore, growing urbanisation, universal access, and government push for infrastructure development and local manufacturing is expected to generate significant new demand for electricity.

Power deficits have been significantly but not entirely overcome. In the past year, India suffered an energy and peak deficit of 3.6% and 4.7% respectively, down from 8.7% and 9% two years back. The industry expects deficits to recur as growth picks up and rural areas are connected. For these reasons, capacity addition remains a priority for the government. The National Electricity Plan 2012 targets a new capacity build of 80 GW for 2012-2017, of which 61 GW (72%) has been achieved.

Annual capacity additions in India (GW)



Source: CEA

The private sector has been at the forefront of this growth (21.7% growth over 2005-15) and now owns 38% (104 GW) of all generation capacity. The private sector has also invested in transmission (e.g. Adani, Sterlite, Reliance, L&T, KEC, Kalpataru, and Tata) and distribution (e.g., Tata, Reliance, Torrent Power, Essel) businesses. However, there have been fewer such opportunities so far.

Although FDI continues to grow—from 157 million USD (2007) to 657 million USD (2015)—it is far below potential. The electricity sector accounts for a mere 4% of all FDI inflows but the renewable energy segment has been a league apart with both strategic and financial investors looking to actively invest.

Changes in policy, regulation and industry structure

The Electricity Act, 2003, (hereinafter the Act) which has facilitated development in the sector, is being amended to introduce new elements to, inter alia, enhance competition and reform the energy mix.

The proposed amendments aim to reform the distribution business by segregating the network and supply business, with the latter to be opened to other players to bring in efficiency and competition. It will also allow consumers to choose their suppliers by eliminating the existing barriers to open access.

The national budget (2015) announced a five-fold ramp-up of renewable energy targets to 175 GW by 2022. This comprises 100 GW solar, 60 GW wind, 10 GW biomass and 5 GW small hydro-power capacity supported by a substantial budgetary allocation. The existing generation capacity is dominated by conventional coal-fired thermal power (192 GW, 70% of total capacity). Non-fossil fuel generation includes renewables (36 GW, 13%), large hydro (42 GW, 15%) and nuclear (6 GW, 2%). The government yet again doubled the clean energy cess from 100 INR to 200 INR per tonne of coal.

The policy amendments will drive the energy mix change through mandatory targets. The RPO for solar power is to be upped from the current 3% to 8% by 2022. Furthermore, a new RGO has been proposed. It requires fossil fuel plants to produce 10% of their capacity through renewable sources, and allows them to bundle renewable and conventional supply in a single contract. The regulators are to be empowered to deal with non-compliance of RPOs and limit cross-subsidy surcharge to 15% of relevant tariff.

The institutional support to achieve these renewable energy goals is addressed in the new draft of the renewable energy law. These institutions include the National Renewable Energy Committee, the National Renewable Energy Advisory Group, and the Renewable Energy Corporation of India. Actions to build the supporting ecosystem are also addressed—resource assessment, testing facilities and a monitoring and verification programme, and policies to promote local manufacturing.

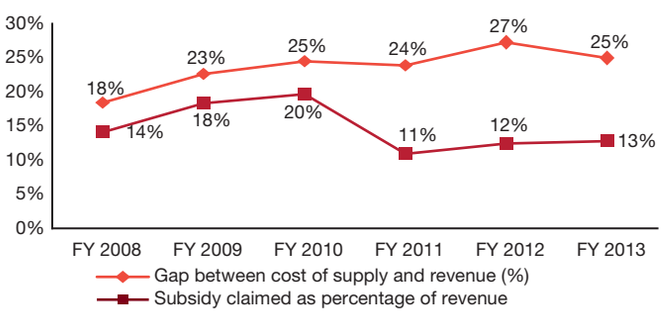
Solar parks (25 parks, each with 500-1,000 MW capacity, totalling 20 GW) are to be developed to benefit small, independent, or international investors who may prefer pre-developed land and infrastructure in which to set up their solar projects. In the initial stage, 10 solar parks are to be taken up in these states—Madhya Pradesh, Andhra Pradesh, Rajasthan, Uttar Pradesh, Gujarat, Telangana, Karnataka, Jammu and Kashmir, Meghalaya, and Punjab.

To enhance the flow of international finance, the government is exploring a new model that allows procurers to tender for solar power projects with tariffs denominated in USD, and to hedge the currency risk through a pool of funds (corpus of 60 billion INR) to be set up.

Key challenges and actions taken

The distribution network connects about 200 million consumers with a total load of over 400 GW. It is served by 73 distribution companies, of which 17 are privately owned. Several of the distribution utilities suffer large volumetric losses and are financially distressed. This raises a significant counterparty risk which is manifested in delayed payments to generators and other suppliers. The cost under-recovery of state utilities is estimated at an accumulated 24,000 billion INR (2012), prompting the government to focus on severely distressed utilities for a turnaround programme.

Under-recovery by state discoms and subsidies from governments



Source: CEA

Regulatory reforms are proposed in the amendments to the Act, such as mandatory tariff determination on an annual basis to cover cost escalation. Further, utilities are required to file for tariff requests on a timely basis. Transmission, particularly, for renewable energy projects, is a challenge, given the low capacity factors and congestion on existing networks. To bring green power to the national market, and minimise curtailment, the government has announced a green energy corridor project to handle 33 GW and 22 GW of renewable energy in two phases of development.

The 765 kV corridor traverses all the prominent renewable states and will have suitable mechanisms for the integration of large-scale renewable energy, such as energy storage, real-time monitoring, and a renewable energy management centre. In addition, the South Asia grid is gradually taking shape, with enhanced connectivity with Bhutan and a new transmission corridor established with Nepal and Bangladesh. This provides investors and large consumers new opportunities for build and power sourcing.

Investment in coal-fired generation has come to a stasis on account of changes in procurement models. Competitive bids for fuel-linked power plants moved from BOO to DBFOT and those for domestic coal-based plants moved back to a modified version of the earlier model. These changes, besides other conditions—demand-supply balance and utilities purchase plateauing—have put many conventional power generation investments on hold.

A number of power plants are stranded or operate under capacity due to fuel shortages. For example, PLFs of gas-based power plants have come down from 67.5% (2010) to 20.8% (2015), with declining production from local gas fields.

Domestic manufacturing in renewable energy is under-equipped to serve the ambitious growth target. Solar PV manufacturing is fragmented with many small players (total capacity is a mere 1.38 GW of solar cells and 2.75 GW solar modules) and lacks vertical integration.

The government programmes for electronics manufacturing have attracted manufacturing tie-ups in recent months. These include China's Hareon Solar with Dalmia Group (1 GW), Adani with Softbank and Foxconn (3 billion USD proposal), and China's JA Solar with Essel Group (200 million USD proposal).

Renewable energy in India

The renewable energy sector in India has made remarkable progress growing from 3.3% (2002) of the total generation capacity to 13.4% (2015). Production rose from 0.4% to 5.6% in this period. Of this, about two-third is from wind, and the balance is from small hydro, solar, biomass and waste to energy, and other sources.

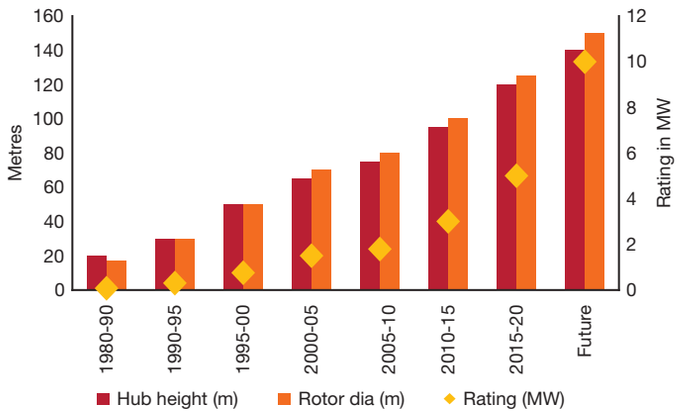
Scale and technology developments

The wind power sector has undergone a major shift in India, from tax-credit driven investment to mainstream IPPs. This has led to the setting up of large wind farms that deploy the latest technology and practices—larger MW class wind turbines, inclusive O&M practices for plant life, use of logistics tools for construction and maintenance, and seamless grid integration. Further, the industry has gained from improvements in drive-train technology, tower structure and use of advance power electronics, which add to overall cost effectiveness.

Turbine costs declined in late 1990s, but have since risen. This is due to a variety of factors—greater turbine dimensions and higher material costs. However, with design technology maturing and production stabilising, costs have started to decline from 2010.

Further gains are expected from the use of lightweight materials such as carbon-fibre reinforced plastic, better aerodynamic profile, on-site manufacturing, segmented blades, and variable-diameter rotor can reduce costs and increase the capacity factor. An US DOE study suggests that the adoption of advanced technology can increase the energy output between 21 to 61% with smaller changes (-36% to 21%) in capital cost.

Technology improvement in wind turbine generators

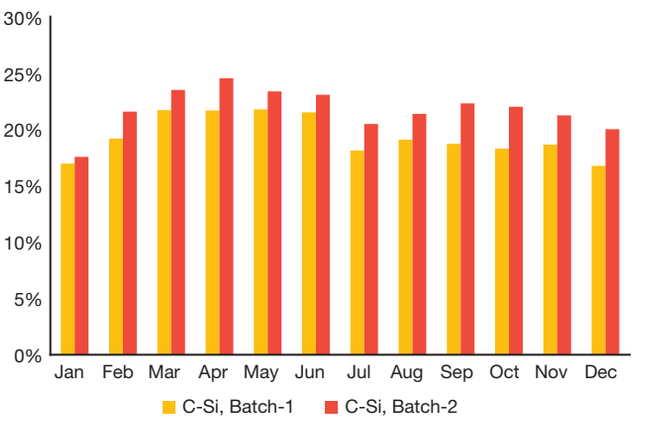


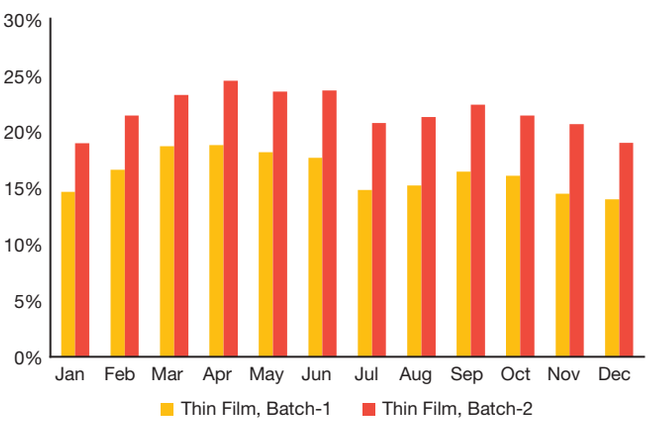
Source: Technology Roadmap–Wind Energy (2013 Edition), IEA; The Economics of Wind Energy, EWEA (2009)

In India, in the last two decades, the hub height and rotor diameter of wind projects have increased fourfold, and the average WTG rating increased almost tenfold. This enhances the energy generated per turbine, thus reducing the overall levellised cost of electricity. Still, the top-end rotor and hub height installed for WTGs in India are 20-30% lower than the global standards, and have scope for improvement.

In solar, the vast majority of Indian projects have adopted crystalline silicon technology, with an average efficiency of 16-17%. The thin-film technologies of cadmium-telluride and copper-indium-gallium-selenide, with 14-15% efficiency, have been used selectively. The expectation is that ongoing scientific research will continue to increase the efficiency in the coming years.

Month-wise PLFs achieved by Indian solar plants (set up under NSM Phase-1) (2014 data)





Source: MNRE

The performance of the solar plants, irrespective of the technology used is higher than the average PLFs observed in Southern Europe. Due to the better utilisation rates, LCOE is lower in India, and comparable to the conventional generation sources.

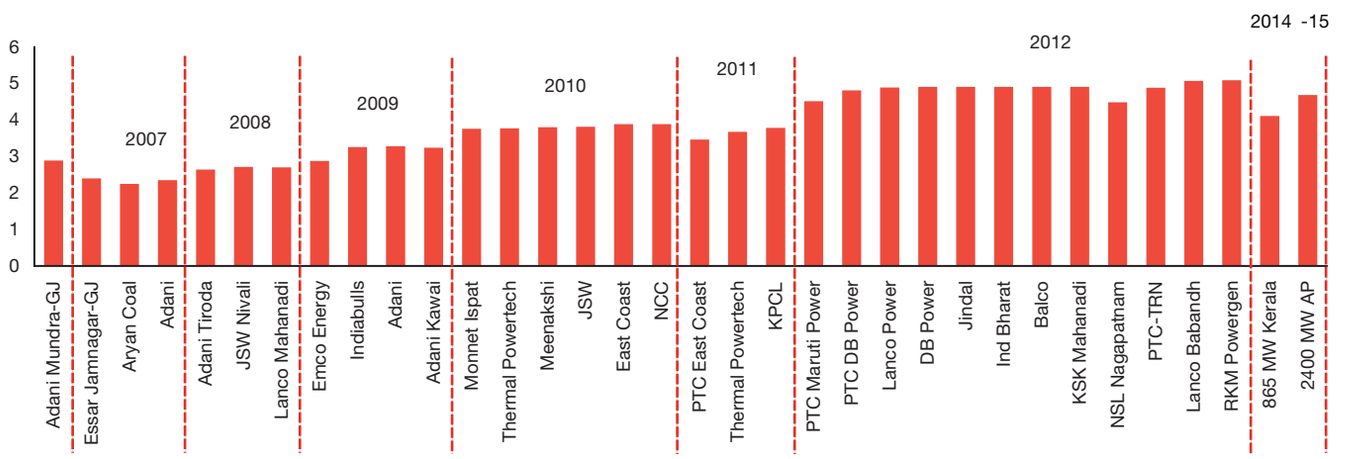
It is interesting to note that the PLF observed between the two prominent PV technologies- C-Si and Thin Film has not been different in Batch-2 of Indian National Solar Mission (NSM) while for the projects commissioned under Batch-1, the performance of C-Si is markedly better.

Economics of renewable energy

The cost of power procured by distribution utilities from existing power generation contracts, largely fossil fuel-based projects, has increased over the years as the costs of fuel, transportation, maintenance spares and labour have risen.

The costs of contracting new long-term capacity have also increased in recent years, with a few occasional exceptions. This is because investors have started factoring in construction and fuel supply risks. Further, under the new DBFOO model, fuel price increases are directly passed to the procurers, in contrast to the past, when generators exercised that option based on their fuel supply contracts.

Tariff discovered in a few Case 1 bids in recent years (INR/kWh)

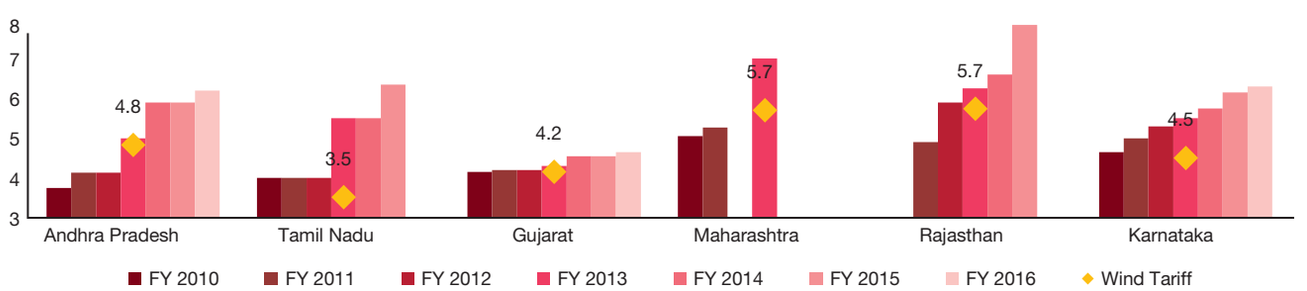


Source: PwC research

The higher power procurement costs are disproportionately borne by large commercial and industrial consumers on account of cross subsidies. This means that large users see renewable energy as a cheaper energy source, and in states with renewable energy potential, several have set up their own captive facilities or have entered into open access contracts. This is advantageous for renewable energy generators too, as it offers higher realisation and better tariffs than FIT.

Renewable energy generators, it must be noted, incur additional costs on open access supply in the form of wheeling charges, imbalance levy and, in many cases, a cross-subsidy surcharge. However, if such arrangements are structured right, it is possible to contract at non-regulated prices that offer generators a better margin and the consumer-buyer, a lower cost.

Increasing trend of industrial tariff: Energy charges (INR/kWh)

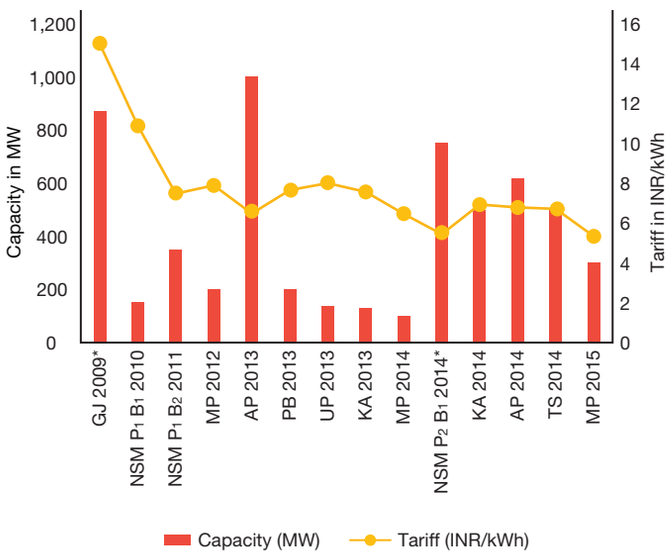


Source: SERC orders

In contrast, renewable energy tariffs have declined in real terms over the years. Solar tariffs, in particular, have fallen in nominal terms from 15 INR per kWh in 2009 to 5 INR per kWh in the recent bids in 2015, with fall in module prices and improvement in capacity utilisation factor.

Solar tariff trend in the last few years

In Madhya Pradesh (July 2015) the lowest bid was 5.051 INR per kWh (6.9 EUR cents per kWh) for 50 MW and the average tariff for the 300 MW bid was 5.353 INR per kWh (7.4 EUR cents per kWh). In Telangana (August 2015, 2,000 MW tender), the lowest bid was 5.1729 INR per kWh (7.0 EUR cents per kWh) for 50 MW. These rates are comparable to the initial tariffs of long-term base load new generation capacity that distribution utilities potentially contract, and are well below the scheduled tariffs that large energy users must pay to utilities.



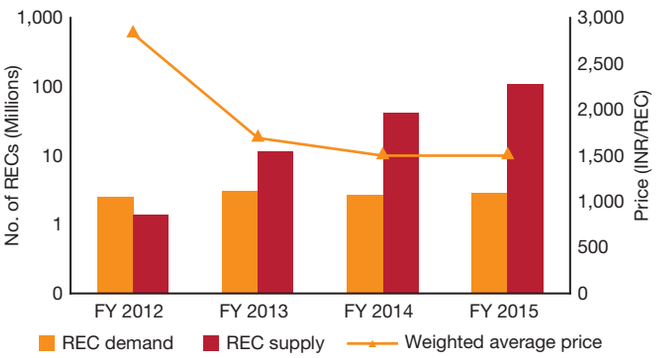
Source: PwC analysis

**GJ refers to Gujarat and is not based on competitive bidding, while NSM Phase-2 is based on VGF.*

Business models

India power markets offer renewable energy generators several options for sale of power. This permits investors with different risk-return profiles to participate in the market.

- Feed-in tariff: The developers sign a long-term PPA at fixed tariffs, which delivers a stable revenue stream. The project can also claim tax credits (AD), income tax exemption and production incentives (GBI). Solar power producers too sign a long-term PPA with utilities at fixed tariffs, albeit these are determined through auction.
- RECs: The developer sells output to utilities at a regulated price (average power purchase cost of utilities) or to third parties and receives REC, which can be traded on the exchange within a preset floor and forbearance price. The buyers of REC are obligated entities, viz. utilities, open access consumers and captives that are not based on renewable energy). As the obligations are not sufficiently enforced at this time, renewable generators have been able to redeem only 13% (solar) and 43% (non-solar) of the issued RECs.



Source: IEX and PXIL

- Open access: The developers can supply output to any third party end user at mutually negotiated rates. Regulators typically levy a predefined cess on such sales to compensate the utilities for the loss of high-value customers. In some states, the cess is waived off or is kept low to permit competition. For renewable companies, these markets offer an opportunity for sale at a higher margin, and the end user gains from negotiated lower energy prices.
- Captive and group captive: A renewable generating company may be structured as a captive or a group captive, wherein the consumers collectively offtake the majority of the output and have ownership in at least 26% of the equity.
- Sites and parks: A company may develop wind or solar sites or establish parks. In a park, the developer establishes infrastructure (land, water, common roads, security, common roads, transmission etc.) and in turn charges a rental fee to users.

State regulators are starting to act to fix the REC market by gradually enforcing RPO. In Maharashtra, for example, the regulator determined (August 2015) that no mitigating circumstances prevented non-compliance other than for mini hydro, and so directed the utility to establish a 'RPO Regulatory Charges Fund' through which it would fund purchases of RECs.

In a recent case (April 2015), the appellate authority, APTEL, directed the state regulators to comply with their RPO regulations. The licensees will be required to include renewable power procurement in their annual revenue requirements. Such advance planning will also help them contract with renewable generators or suitably time their REC purchases on the exchange. In another order in Gujarat (April 2015), the APTEL opined that RPO achievement could not be carried forward to a future year when RECs are available in the current year.

These regulatory and appellate directions suggest an improving regulatory climate that supports the development of renewable energy.

Incentives and preferences

An investment in a renewable energy project enjoys a wide range of state support.

Tax benefits in the form of accelerated depreciation for wind and solar projects (80% p.a. on the written down value) allow companies with a large adjustable income to save on tax whilst acquiring a valuable asset. These incentives are to phase out in 2017 and, until that time, offer a strong financial incentive.

A power generating company is granted income-tax exemption for 10 consecutive years of its initial 15 years of operation, although MAT on book profits is payable during this time. A MAT credit (difference between that paid as MAT and the normal income tax) can be, however, carried forward and set off when normal income tax becomes payable.

The GBI introduced in 2009 offers wind power generators at 0.50 INR per kWh, supplied subject to a cap of 10 million INR per MW. This benefits the IPPs who have no use for tax credit in the initial years.

As a specific policy support, preferential treatment for wheeling and open access is extended to renewable energy companies in several states. The typical costs in competitive third-party sales are transmission and wheeling, banking (to match the time of use of generation and consumption), and the compensatory cross-subsidy surcharge. The extracts from open access policies in the states listed below clearly show the favourable deals offered to wind energy generators looking to sell directly to retail consumers. This represents a significant incentive, considering the value at risk involved for the utilities.

State	Wheeling and transmission charges	Banking	Cross subsidy surcharge (CSS)
Tamil Nadu	40% of charges applicable to conventional power	Banking period: 1 financial year	50% of rates applicable for conventional power
Gujarat	100% of charges applicable to conventional power	Captives: 1 month banking Third-party sale: No banking allowed	Nil for non-REC projects
Maharashtra	100% of charges applicable to conventional power	1 year	25% of CSS applicable to conventional power
Rajasthan	50% of normal charges	Banking on 6-month basis	Nil
Karnataka	5% in kind	12 months banking with 2% charge	Applicable as per SERC orders
Andhra Pradesh	Nil for renewables	2% of the energy delivered at the point of drawal	Applicable as per SERC orders

Investments and financing

The market opportunities in renewable energy have attracted a number of strategic and financial investors to India. Many have leveraged international financing to build their initial portfolio and are now looking at alternative models for their operating assets.

IPP	Investor
Leap Green Energy	JP Morgan
Renew Power	Goldman Sachs, GEF, ADB, ADIA
Green Infra	IDFC, Sembcorp
Bharat Light and Power	DFJ Ventures, Enel Green
Continuum Wind Energy	Morgan Stanley
NSL Renewable Power	FE Clean Energy, IFC, ADB
Greenko Group	GIC, EIG Global Energy Partners
Mytrah Energy	Merrill Lynch, Aion Direct, IDFC, Apollo Global Management
Welspun Renewable	ADB, KfW, GE Energy Financial Services
Amplus Solar	I-Squared Capital Infra Fund
Energon	Equis Funds Group
Acme Cleantech	EREN Renewable Energy and EDF Energies

These IPPs have been active in the secondary market too, taking advantage of renewable asset sales by several large corporates who built these earlier for a tax break or captive sourcing but who are now financially stressed or have decided to focus on their core business.

The government policies have been supportive to renewable energy companies seeking FDI, multilateral and development bank funds or external commercial borrowings. The government's own direct support, however, has focussed on smaller projects, first of its kind technologies and demonstration pilots.

The central bank has categorised renewable energy as a priority sector for bank lending from this year (commercial banks are obligated to lend a certain proportion to defined priority sectors such as agriculture, small enterprises and housing). If renewable energy, hypothetically, absorbed about 1.5% of net bank credit (within its allowed limit), it would meet the entire debt requirement for 150 GW up to 2022. This is unlikely, however, as individual loans are capped at 150 million INR per project.

A more realistic prospect is concessional or long-term finance. The sector financial institution, Rural Electrification Corporation, now extends loans to renewable energy projects at 75 basis points below that to comparable conventional generation projects.

On the whole, the lack or limited availability of non-recourse finance is the greatest deterrent to new entrants in the renewable energy sector. The banks' concerns are founded in their view of the resource risk and counterparty risk. To mitigate these, lenders seek corporate or promoter guarantees or expect the parent company to extend balance sheet support.

Developers also face an evolving interest rate risk. Against the project life of 25 years, commercial banks are able to extend loans at best of 10-12 year term, given their average deposit base of 3 years. Non-banking finance companies have a limited capacity. The corporate bond market has not evolved as long-term investors such as insurance and pension funds are kept out by the rating threshold. Multilateral funding, excepting their non-sovereign private sector investments, is limited to PPP projects. Still, the share of bank finance to infrastructure has increased from 3.7% in 2003 to 15% of gross bank credit in 2014.

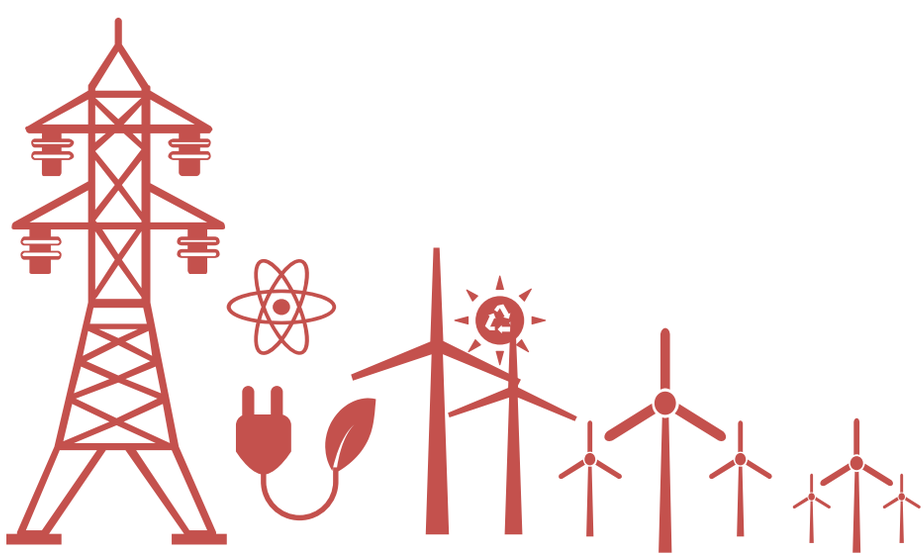
With economic slowdown in infrastructure including conventional power projects, renewables are increasingly seen as an opportunity by the banks and financial institutions for funding big ticket projects.

To address the ALM issue, the central bank has allowed flexible restructuring of long term project loans, colloquially known as '5:25 flexible structuring scheme'. The lenders are allowed to take on a longer tenure for loan repayment, say 25 years, with periodic refinancing, say every 5 years. The repayment at the end of each period will be structured as a bullet repayment. The repayment may be taken up by the same lender or a set of new lenders and such refinancing may repeat till the end of the amortization schedule.

Green bonds are another option that the developers are adopting, especially after recent successful instances such as Exim Bank, Yes Bank & CLP.

To broaden the sources of funding, the central bank has also issued guidelines for issuance of Rupee denominated bonds overseas by Indian firms.

Credit enhancement is also being used by an operational wind energy project that secured refinancing through credit enhancement offered by IIFCL (a Government of India company with a focus on funding infrastructure projects) and ADB, which helps the project secure longer tenor and reduced interest costs.



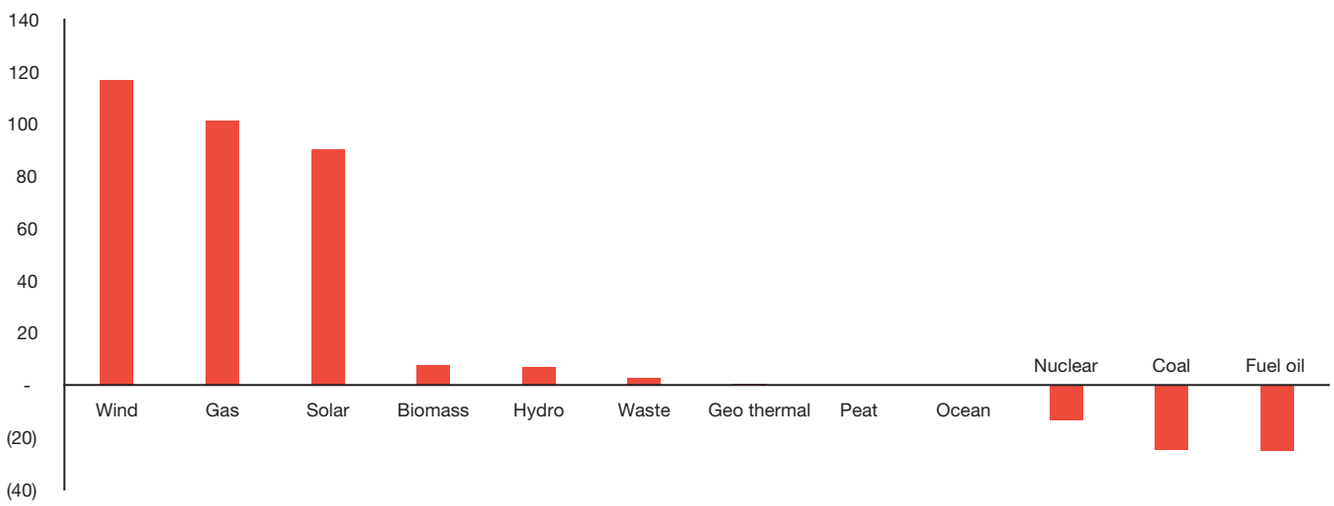
A comparison with European markets

Renewable energy taking centre stage

Renewable energy accounts for 26% (excluding hydropower) of the total electricity generation capacity of 910 GW in the EU (2014). This is primarily from wind (14%) and solar (10%) power. The leading nations are: in wind power, Germany (39 GW) and Spain (23 GW) and in solar power, Germany (38 GW) and Italy (19 GW).

The dramatic shift in energy mix is illustrated by the fact that renewables constituted the bulk of EU's generation capacity addition for the seventh consecutive year (last year, as much as 78% of new capacity came from renewables). In the period from year 2000 to date, EU nations added renewable energy capacity of 326 GW while convention technologies such as coal, nuclear, and fuel oil recorded a phasing out of 63 GW.

Net electricity generating installations in the EU 2000-2014 (GW)

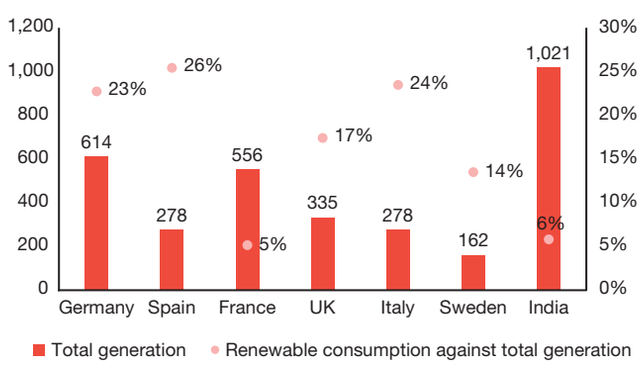


Source: The European Wind Energy Association-2014 European Statistics

India, faced with the challenge of a growing population, provision of rural electrification, and deep energy shortages, simply had to grow all generation sources. So, in this period (2000-14), India added 156 GW in conventional energy and 31 GW of renewable energy; the share of renewable energy growing from 1% to 12% of total generation capacity. A further transformation is expected as the government sets to deliver its ambitious goal of 175 GW from renewable energy sources by 2022.

Developed nations too expect continued growth of renewable energy generation. In fact, Europe expects a renewable energy new build of as much as 109 GW (IEA estimate) by 2020. This goal is for renewable energy to supply targeted 15% of gross final energy consumption. India, already a large renewable energy player, has set a target of generating 15% of its energy from renewable energy sources by 2020 under its National Action Plan on Climate Change.

Renewable penetration in select European markets (TWh/year) 2014



Source: BP Statistics 2014, Growth of electricity sector in India from 1947-2015, CEA

Key policy drivers

Market creation is a powerful and important role played by the governments supporting the growth of renewable energy. This is done through policy targets and mandatory obligations.

France targets 40% of its electricity demand to be met by renewable energy by 2030. As stated earlier, India is aggressively pursuing a goal of 175 GW of renewable energy by 2022.

Feed-in tariffs and renewable procurement obligation, over the years, have been an effective tool to incentivise renewable energy investments. As the industry grew, especially with entry of IPPs and large scale projects, governments moved away from feed-in tariffs to market-based mechanisms such as tradeable green certificates, market premium, and tendering. Fiscal incentives such as capital subsidy, tax credits, lower taxes, public investment support, and energy production payments helped renewable energy generators compete in the mainstream power markets.

In the recent years, price support and incentives for renewable energy companies in Europe is undergoing a significant change.

Feed-in tariffs

FIT schemes have been a popular tool for many years, offering a simple model and high returns to investors. New EC guidelines (2014) require the countries to move to competitive tenders from 2015-16 and from 2017 all new projects will be solely delivered through tenders. Further, Germany and Italy cut their FIT rates especially in solar PV and wind generation. Spain (2012) suspended its FIT for new projects, and some policy changes also had a retroactive effect. In India, FIT remains the mainstay for most renewable energy technologies, but solar has made a successful transition to competitive bidding.

Market premium approach

This offers generators a premium over market price for green electricity. Germany (2012) permits renewable energy generators sell on the power exchange, and the grid operator pays to help offset shortfall in price realisation against EEG remuneration. Likewise, Italy requires renewable projects above 1 MW to sell on the electricity market and receive a premium corresponding to the gap between a base FIT and monthly or hourly zonal electricity price (for controllable or variable renewable generation). The premium for larger projects could be set through competitive tenders.

Tendering

As mentioned earlier most jurisdictions are moving towards tendering to procure renewable energy projects consulting with private sector on the design. Procurers in India are testing a wide range of procurement models in solar power—viz. staged bidding at sub-station level, solar park tenders, dollar-linked pricing, viability gap funding, and so on.

Net metering

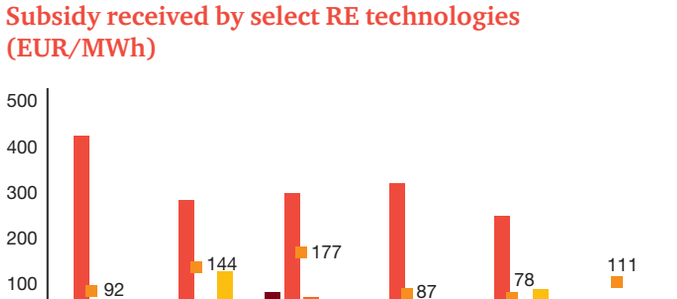
Net metering largely supports small-scale renewable energy systems such as roof-top or solar agriculture pump-sets, offering producer-consumers a revenue stream or save on power bills whilst helping utilities limit tail-end losses. Net metering policies are now available in over 48 countries (2015). In Italy, for example, net-metering is available for facilities that are 20 to 200 kW. In India, several states, viz. Karnataka, Andhra Pradesh, Tamil Nadu, Rajasthan, Maharashtra Delhi, Odisha have announced net metering policies.

Tradable green certificates

Green certificates permit renewable energy generators to monetise by their sale to obligated entities that are short of their renewables procurement targets. The value of the certificate itself varies, and depends on the supply and demand. Further, these programs are now differentiated, for example, with different shelf-life, or with a multiplier to promote particular technologies. Spain, France and the UK amongst others have implemented this. Italy, on the other hand, plans to phase it out. India launched its Renewable Energy Certificates in 2010 and are tradeable since 2011.

Fiscal incentives

Subsidy received by select RE technologies (EUR/MWh)



Source: CEER

A common incentive is tax credit or tax exemption for investment in renewable energy, which many countries such as France and India offer. India extends a 10-year corporate income tax holiday besides an accelerated depreciation of 80% for solar and wind installations. Italy offers a 10% discount on VAT for investment and services in renewable energy. Also, its municipalities can grant a discount on real-estate tax to buildings that are equipped with a renewable energy installation. Similarly, to promote energy efficiency in urban areas, Spain set up a fund (2014) to support projects delivered through ESCOs and other solution providers.

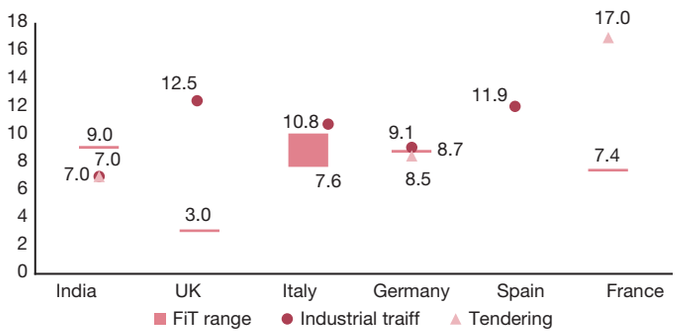
Development banks in several countries offer financing at concessional terms for renewable projects that are small, or are high risk and involve first of its kind technology. For example, KfW in Germany extends loans for offshore wind projects within its economic zone. In the UK, developers can secure loans for 45 energy-efficiency measures (Green Deal Order 2012) repaying for them through energy bills. France supports demonstration projects in green chemistry, low carbon vehicles, smart grid, low-carbon buildings, energy storage and carbon capture and storage. India extended home loan coverage to include the cost of roof-top solar and included renewable energy in priority sector lending of commercial banks. A specialist agency, the IREDA, extends concessional loans for small installations, support for pilot projects, and other investment facilitation.

Market design can also play a role. Decentralised generators, which could be renewable or conventional forms, benefit from negative connection charges or exemption from wheeling charges, in recognition of benefit they bring in avoided losses or voltage support.

Tax on other suppliers is an effective incentive in competitive markets. For example, the climate change levy on consumption and carbon price floor on fossil fuels in the UK place a price on the externalities. India has increased its carbon cess by four times in successive years.

Mainstreaming renewables in power markets

Solar generation tariffs (FiT and auction prices) vs retail industrial tariff (EUR cents/kWh)



Source: PwC research

The price paid for renewable energy in most developed markets remains well above their short term marginal power costs, even with recent declines in overall electricity costs and costs of new renewable energy projects.

In Germany, wholesale electricity prices averaged 34.8 EUR per MWh in 2014, about 8% lower than the year before. A similar decline is seen in France (40.9 EUR per MWh), Spain (42.2 EUR per MWh), UK (57.6 EUR per MWh) and Italy (58.6 EUR per MWh).

In comparison, in Germany, a recent tender for a large solar project (150 MW) discovered a tariff of 8.49 EUR cents per kWh, comparable to the FIT (for projects up to 10 MW) of 8.72 EUR cents per kWh. In Italy, the base tariff for tender of onshore wind projects is 12.7 EUR cents per kWh with an annual digression of 2%. The price discovered in recent tenders for delivery in 2015 is 10.6 EUR cents per kWh.

In India, recent tenders of long-term contract for coal fired base load power were awarded for tariffs of 3.60 INR per kWh to 4.29 INR per kWh. The long-run cost for the 865 MW contracted comes to an average of 4.11 INR per kWh.

In comparison, the FIT for large wind projects range from 6.1-8.2 EUR cents per kWh(4.50-6.02 INR per kWh). Solar power project tenders have successively delivered lower tariffs and a recent 300 MW bid in the state of Madhya Pradesh attracted 100 bidders with the lowest quote of 7 EUR cents per kWh albeit fixed for the project life.

The changing economics of renewable energy projects

Decline in capital costs and technical improvements

The cost of installing new wind farms and utility-scale solar projects has declined in recent years, and is significantly lower in some regions of the world. Solar PV, in particular, has proven a highly reliable technology and module prices declined dramatically (prices in 2014 are 75% lower than in 2009).

The cost of new wind projects in India and China are materially lower than, say, in Europe. This reflects lower production and labour costs, as well as competition between a large number of locally focussed manufacturing and construction companies. Wind farms in Europe deploy higher capacity units which cost more per MW but deliver higher PLFs. For this reason, a simple comparison of WTG prices does not tell the full story.

Capital cost: Wind installations

	USD/kW
Italy	2,452
France	2,065
Germany	1,999
UK	1,874
Europe	~2,000
India	1,139

Source: PwC research

The cost of land and land related taxes or compensating for loss of aesthetics adds to the cost structure of a renewable energy project. In Germany, wind farms could incur land lease rental of 7-8% of revenue annually over project life.

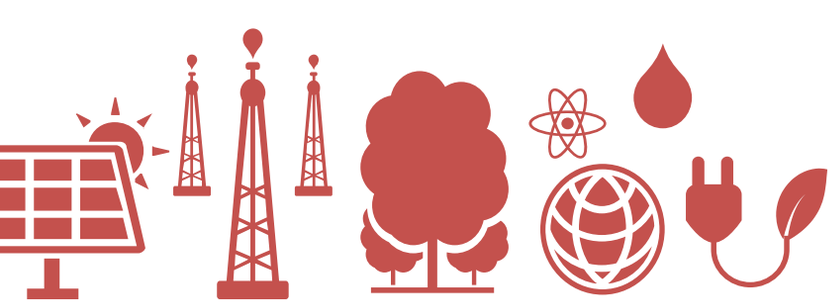
Technological improvements and larger scale installations have significantly enhanced efficiency of renewable projects.

Wind turbine technology now permits larger diameter rotors and higher towers that generate higher electric output. Wind farm PLFs now range from 20-50% for onshore and 30-45% for offshore sites.

Onshore wind turbine technology

	WTG-MW for hub height of 90 m
UK	2.05-3.4
France	1.85-2.4
Germany	2.0-3.0
Italy	2.0-3.0
Spain	2.0
India	2.1 (Hub height 80-120 m)

Source: PwC research



Solar project PLFs on a global level improved from a low 12-18% level in 2010 to 25% in 2014. Higher PLFs and the sharp decline in panel prices helped dramatically improve LCOE closer to grid parity. LCOE of solar PV generation in Southern and Central Europe is 5-8 EUR cents per kWh (2014), and in India it ranges between 6.6-7.7 EUR cents per kWh (2014).

Technology	Features	Capital cost (USD/kW)	LCOE (USD cents/kWh)
Solar PV ground mounted utility scale	Peak capacity: > 1-250+ MW Capacity factor: 10-25% (fixed tilt)	1,200-3,000 (Global) 1,495 (Germany) 2,080 (UK) 970 (India)	14-34 (Europe) 7-8 (India)
Solar PV rooftop	Peak capacity: 3-5 kW (residential) 100 kW (commercial) 500 kW (industrial) Capacity factor: 10-25% (fixed tilt)	2,200 (Germany) 2,400-3,000 (Italy) 960-1,000 (India)	16-38 (Europe) 9 (India)

Source: REN 21, Renewables 2015 Global Outlook, PwC research

Erection and construction costs vary considerably across regions, but have declined in most places. Onshore wind installation price went up from 700-1,200 USD per kW (2003) to 1,330-3,060 USD per kW (2010) declining thereafter to 1,280-2,290 USD per kW (2014). Solar PV installation costs have sharply fallen from 3,700-7,060 USD per kW (2010) to 1,570-4,340 USD per kW (2014), led largely by decline in panel prices which fell from 2-4 USD per W (2009) to under 1 USD per W (2014).

BOS, which constitutes 40-50% of the project costs, is also cheaper. Inverters are cheaper by 29%, other hardware by 20%, and racking and mounting by 12% in this period (2010-14). The BOS cost for rooftop solar systems have declined by larger proportion. In Italy, BOS declined by 55% for smaller systems (1-3 kW) and 77% for larger ones (200-1,000 kW).

Market-based income stream

In many developing countries, renewable energy is already a commercially viable energy source and adopted by consumers as a captive source, or is established by IPPs for competitive power trade. Developed nations, on the other hand, are now gradually introducing greater market based approaches to make renewable energy more cost efficient.

Germany

A recent amendment to the Renewable Energy Sources Act in August 2014 requires new renewable energy projects above 0.5 MW to sell power directly (mandatory direct marketing) receiving in return certain compensation (market premium). From 2017, however, all financial support to renewable energy projects would be granted via tenders. The extent of support is also capped, for example, 52 GW for solar.

France

France conducted its first auction for large solar projects (arrays above 100 kW) in 2013. The bid prices discovered on average fell from 23 EUR cents per kWh to 17 EUR cents per kWh that year, to 15.3 EUR cents per kWh in 2014.

Italy

Non-solar renewable projects above 1 MW are supported through a feed-in premium, which represents differential between a base FIT and monthly zonal electricity price (for dispatchable sources) or the hourly zonal electricity price (for variable sources). For larger projects, this premium is set through tenders with an overall cap for fiscal support.

Solar projects above 1 MW, under legacy programs, are offered feed-in premium for electricity supplied to the grid and consumed on-site. No incentives are now extended to new solar power plants. A new regulation (Ritiro Dedicato) offers slab tariffs for generation up to 2 GWh of wind or solar power, and thereafter local market prices (monthly rates differentiated by location and technology).

Tenders are floated for wind power projects above 5 MW with a procurement cap (500 MW for 2015). The tariff discovered in the first round (2013) was a base of 12.4 EUR cents per kWh, and in the next round (2014) ranged between 10-11.2 EUR cents per kWh. Italy has not tendered solar power projects.

United Kingdom

Income of renewable energy generators comes from FIT, Contracts for Difference (CfD) and from sale of renewable certificates. Also, all renewable generators supplying their surplus to the grid receive an export tariff of 7 EUR cents per kWh.

FIT at rates set by OFGEM is offered to producers with capacity of up to 5 MW. All licensees are required to source a defined percentage of electricity they supply to consumers, from renewable generators, who in return earn ROCs that are tradeable. This is available to new renewable generators only up to March 2017 (or March 2016 for large solar projects).

Larger renewable IPPs sell into the market, supported by a variable top-up which depends on the pre-set strike price (set by auctions, for each year, and differentiated by technology), and it can be positive or negative. To date, 2.1 GW of solar and wind capacity is procured at a potential cost of 435 million EUR. From April 2017 all new renewable energy generators above 5 MW can only contract through this route.

Spain

Renewable energy was promoted by regulated prices largely until 2012. Since then, Spain suspended FIT for new projects besides certain retroactive policies for past projects based on principles of reasonable return and productive efficiency.

Renewable energy generators can now opt for a premium tariff, which is offered over the price earned on the wholesale market. The premium depends on a reasonable return, balance life of the asset, and benchmark costs set on a theoretical standard.

India

Most solar projects have been competitively tendered since 2012. A recent bid for 300 MW was closed at 8 EUR cents per kWh with a median tariff of 7.5 EUR cents per kWh.

Wind projects are currently compensated through FIT set by state electricity regulators and are now increasingly differentiated by wind zones (Maharashtra has five zones helping it tap sites in low wind regions).

To manage sales risk, several renewable energy companies use a mix of sales models- sale on FIT and contestable supply to third-party consumers using network open access.

Grid access and curtailment

The regulatory and administrative processes for grid connection, access, and dispatch can materially affect the profitability of renewable generators. Most jurisdictions support provision of non-discriminatory access and a must-run principle for dispatch.

In Germany, for example, grid operators are required to extend or strengthen networks when sought by renewable energy generators seeking to connect. In principle, curtailment is meant to be last resort to protect grid stability, and in such event, renewable energy operators are entitled to a compensation payment. To manage decentralised interruptible generation, remotely controlled devices are mandatory for all installations over 100 kW.

In developing countries with limited reserve capacity and multilayered grid operation, this can be a challenge. In China, about fifth of the installed wind power capacity is lost (doubling to 10.7 TWh in Q1 2015) due to curtailment issues. In several countries, active consultation and studies are being undertaken to address curtailment.

Operating costs

Wind projects incur operational expenses of 20-30% of revenue at a project level.

Operations and Maintenance (O&M) costs of wind power projects have declined in recent years. Full-service contracts which include payment for scheduled and unscheduled maintenance and parts replacement has fallen from 47 USD per kW per year in 2008 to the current 28 USD per kW per year (2013 data).

In Germany, it has ranged between 64-67 USD per kW (2011-2014) and 47-49 USD per kW for same period. O&M costs of India wind projects average around 1-1.1 million INR per MW per year (15-17 USD per kW per year) excluding insurance costs.

Solar projects: O&M cost for solar projects in European markets is about 20 to 25 USD per kW per year, which would include regular maintenance, cleaning, and inverter replacement reserve. In India, the corresponding cost is about 10-20 USD per kW per year.

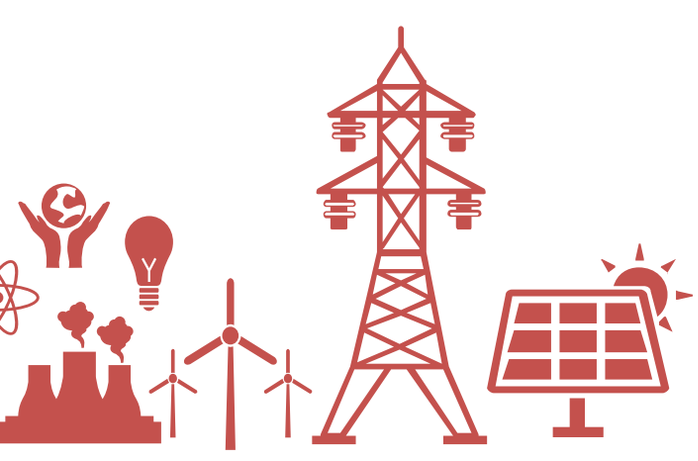
Solar power developers are increasingly looking at solutions to reduce operating costs. Panel cleaning, which entails 2.5 to 10 USD per kW depending on the complexity can be managed through mobile robotic systems. This adds to the capital cost (3%) but reduces operating costs and boosts energy output (8%), resulting in an overall gain.

Financing

The cost of debt in India is high at 12-13%, compared with 3.5-4.5% prevalent in most European jurisdictions.

The expected return equity investors seek from renewable projects in European markets is a modest 6%. These assets have attracted strong investor interest seeking to build a portfolio of secure low-risk assets with predictable cash flows.

A wide range of investors, from development banks, commercial finance companies and public markets (private placement, IPO, Trusts, Yieldcos) are actively interested in renewable energy investments. A sponsor pools a set of long-term contracted operating assets in a Trust/Yieldco delivering a reliable cash flow and hence better valuation, and releasing cash that can be deployed in new assets. To maintain this cycle, sponsors seek a continued supply of projects either green-field or acquired.



Imbalance costs

Grid practices for forecasting and scheduling vary by country. Some jurisdictions require wind generators to forecast and schedule generation (from 0.5 to 24 hours prior) and are charged for imbalances (e.g., Spain, Sweden, Denmark, UK). Others markets require it to be scheduled but are not charged for imbalance (e.g., Germany, France, Italy).

In the US, most power pools (CAISO, MISO, NYISO, PJM, ERCOT) forecast wind generation, but other than CAISO, most have adopted it only recently. FERC Order 764 recognises that transmission providers need better information to manage the cost of ancillary services, even as additional ancillary services will be required to manage a larger proportion of renewables.

In Germany, wind power operators are considered must-run and do not have to forecast. The four transmission system operators (TSOs) pool all renewable energy, run forecasting tools, balance the system and allocate the associated costs for respective control areas. The TSOs maintain a primary reserve capacity (that can come on line in 30 seconds), and in addition secondary (5 minutes) and tertiary (15 minutes) reserve capacity.

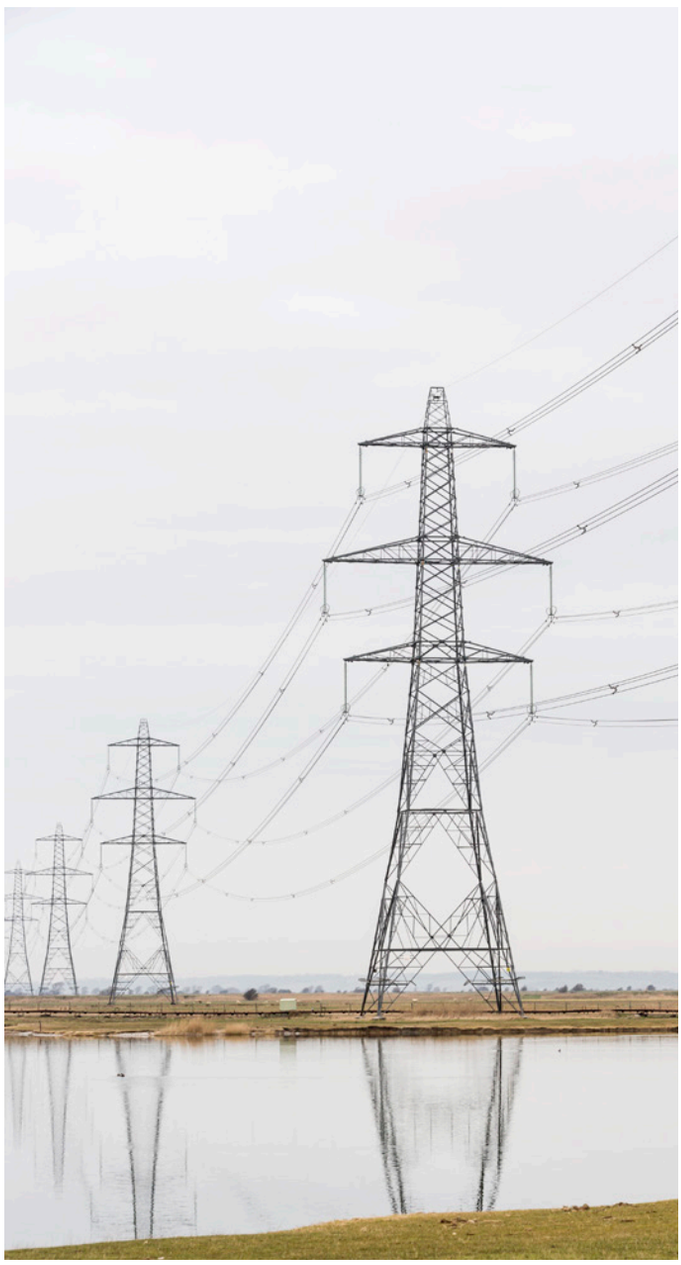
In contrast, in Spain, all generators including renewables pay for the costs of balancing energy, which is in proportion to the market prices of energy. Red Eléctrica, the grid manager, uses weather forecasts and a forecasting tool to assess need for reserves.

In India, CERC introduced provisions for renewable intermittency (May 2010), under which any deviation from schedule outside a 30% band are charged for schedule deviation. This was contested for many reasons, and following industry consultations, a new set of regulations were issued in August 2015 with the following salient features:

- Mandatory scheduling for wind and solar projects of 50 MW and above, and permitted schedule revisions increased from 8 to 16 per day
- Penalties for schedule deviation outside a 15% band, with the penalties between 10-30% of a fixed rate as per the PPA or APPC
- Commercial settlement delinked from UI, and undertaken through the deviation settlement mechanism

Currently, the costs towards intermittency and transmission to evacuate low PLF plants are socialised and paid by all users. This will continue to be the case for smaller renewable projects, and investment in grid-scale storage (battery, chemical, pumped hydro) is necessary to tap the renewable potential. An earlier assessment by IESA (prior to upward revision of renewable energy targets) suggested a scope for 15 GW across various energy storage technologies by 2020.

The expectation is that states will also start investing in the use of weather monitoring data; use of statistical models for forecasting; build capabilities of the system operator for forecasting and managing ancillary services with a higher share of renewables in the mix, and in course of time, as the industry matures, tighten the penalties for schedule deviations.



The implications: A relook at where to invest in renewable energy

Subsidy dependence vs grid parity

The prospects of renewable energy are arguably the best in regions where subsidy support is minimal and where it sells into a commercial market on an equal footing.

The subsidy support in European jurisdictions ranges between 11-84 EUR per MWh for onshore wind and between 11-448 EUR per MWh for solar projects. The average for the EU is about 111 EUR per MWh (2013). As discussed, many countries are re-evaluating the support level and moving towards auctions and market driven pricing.

In India, the support is minimal and renewable energy tariffs are comparable with that seen in the auction of coal-fired base load power. The table below compares conventional power tariffs discovered in the last 12 months and the current renewable FIT.

Procurement	Source	When	Tariff (INR/kWh)	Tariff (EUR/MWh)
Kerala-400 MW*	Coal	November 2014	4.22-5.48	57-75
Kerala-450 MW*	Coal		4.90-5.73	67-78
AP-2000 MW*	Coal	June 2015	5.20-5.70	71-76
MP-300 MW	Solar PV	May 2015	5.05-5.64	69-77
Telangana-2000MW	Solar PV	June 2015	5.17-6.01	70-82
Punjab-500 MW	Solar PV	July 2015	5.09-5.98	69-81
Rajasthan	Wind#	Current applicable FIT	5.74-6.02	78-82
Gujarat	Wind#		4.15 with AD, 4.52 without	56-61
Maharashtra	Wind#		3.92-5.70	53-78
Karnataka	Wind#		4.50	61
AP	Wind#		4.83+Tax reimbursement	66+Tax reimbursement
Telangana	Wind#		4.70	64
MP	Wind#		5.92	81
Tamil Nadu	Wind#		3.51	48

*Notes: *As tariffs bid are for the first year, they are levellised for 25 years to enable comparison.*

#GBI of 0.50 INR/kWh (capped at 10 million INR/MW) to be redeemed in 4-10 years from commissioning is not included in the tariff.

A part of the reason for higher subsidy support for renewables in Europe is readily explained. In onshore wind, the capacity factors, on an average, are comparable in Europe (26%) and in India (23%), and so the higher level of support is mainly towards higher capital and operating costs. In solar, lower resource potential (average PLF in Europe of 15%, against 21% in India) necessitates higher support. It must also cover higher capital cost (Europe 1,400-2,200 USD per kW against India 1,294 USD per kW) and higher operating costs (Europe 20-25 USD per kW against India 10-20 USD per kW).

Extracting value

However, resources factors and cost structure do not tell the full story. The shift to auctions and market pricing in EU/OECD countries suggests that India now presents a more attractive region for financing renewable projects. This can be studied in a hypothetical case.

Consider a typical solar project in India with capex of 1 million USD per MW financed at long term bank debt of 12% and earning a tariff of 8.50 USD cents (5.50 INR) per kWh. The project will fetch equity IRR of about 15%.

If overseas debt is applied at rates prevalent in European markets for renewables, viz. 300-400 bps spread over 10 year USD Government Bond yield, and rupee depreciation of 3-4% is added (25-30 year trend), the equity IRR comes to around 16-17%, which is well above the expectation of equity investors in European electricity markets (5-7%, as per CEER).

Furthermore, for a given capital outlay, given the lower capital costs in India compared to EU/OECD countries, an investor can fund more projects, thereby diversifying risks.

International investors investing in India will also help expand and secure the market. We can see this by extending the hypothetical case mentioned above.

For the above mentioned solar project in India (capex of 1 million USD per MW, rupee debt at 12%, equity IRR of 15%), a typical bidder is likely to quote 5,400 INR per MWh (73.5 EUR per MWh) in a generic auction. However, with international funding on terms described earlier, factoring in long-term Rupee depreciation, a bidder can quote 5,060 INR per MWh (68.5 EUR per MWh).

Lower tariffs will encourage power utilities to procure more from renewable energy sources, thus expanding the market. Moreover, utilities are likely to service these contracts better as they contain no fuel risk, do not impose take-or-pay commitments and are comparable in price to other long-term marginal sources.

Renewable energy prospects in India

India presents a reliable, fast growing, well-diversified, and profitable market opportunity for renewable energy.

Market opportunity

The imperative to add substantial new generation capacity to meet social and economic needs is helping India reshape its energy mix towards renewables quicker than other regions. Power utilities and retail consumers alike are contracting with large-scale renewable energy suppliers to meet their basic energy needs.

India's per capita energy consumption is very low, in fact, it is about one-third of the world's average and below other comparable developing countries. The growth picked up in recent years rising from 612 kWh to 1,010 kWh over last decade (2005-2015)—a growth of 5.1% per annum.

Rural electrification and provision of 24X7 power supply is a key priority for the government. Based on available statistics 19,706 villages lack access (2015), and a large proportion of households (33%) do not own an electricity connection (2010 Census). In most states rural power supply is intermittent and of poor quality. New generation capacity must be built, and given the affordability and concerns of marginal consumers, renewables with minimal cost inflation suit it best.

Urban centres, too, have grown rapidly and India, which is relatively less urbanised with only 31% of population in cities, is moving in the direction of other developing nations such as China (50% urban population) and Brazil (87%). Urban areas are significantly more energy intensive and constitute a key driver of demand growth.

Policy support

Energy security is a prominent policy concern. Primary fuels are India's single largest import, accounting for 37-40% (2013-2015) of total imports and periods of high commodity prices have resulted in constrained supplies, budgetary deficits, and fuelled inflation.

Climate change is a key consideration too with coal responsible for 76% of electricity produced. The government's drive to build 175 GW of renewable energy by 2022 will help achieve energy security and reform energy mix. The policy proposes to use RPO and RGO targets to develop this, and regulators are seen to take steps to improve enforcement.

The government has set in place a robust procurement model in the form of auctions and standard bidding documents (RFQ, RFP, PPA) to facilitate a quick, harmonised, and transparent bidding process for solar power development.

Public interest and local development

Public opinion has been supportive of sustainable energy in India, and this has helped states maintain a positive and stable policy environment over the years. On similar lines, a number of private companies are setting up renewable energy projects for their own use, or have committed to source 100% of their consumption from green sources. State-owned organisations are tasked with establishing 10 GW solar projects.

The courts too have taken a positive view. The Supreme Court of India recently (May 2015) ruled that renewable obligations are in larger public interest and can be imposed on captive users and open access consumers.

Renewable energy projects are often located in distant and remote areas and in some cases in arid lands. Employment, even in limited numbers, improves social and economic prospects of the region. Decentralised energy initiatives such as roof-top solar power plant and solar-powered agriculture pump sets offer scope to generate electricity at the tail end of the grid, and potentially where net metering policies are in place thus offering a modest source of income.

Economics and profitability

Renewable energy build, as described earlier, is increasingly competitive with electricity from mainstream fossil fuels such as coal and natural gas. This is driven both by a variety of global factors (e.g., technology, module prices, and optimisation) and local factors (competition in capital goods and EPC, financial engineering, new entrants, and captive users).

The competition is a strong force. India has about 20 wind turbine manufacturers with an annual production capacity of 11 GW. A majority of these (Suzlon, WindWorld, Inox Wind, Regen Powertech, Gamesa) offer a complete turnkey solution whilst others (GE and Vestas) focus on products. The supply of solar modules is predominantly from imports whilst the balance of plant and inverters are locally sourced. The solar EPC market is also very heavily contested offering competitive pricing and turnkey solutions to developers.

The state electricity regulators maintain a provision of post-tax return of 14-16% in tariff determination for relevant renewable energy technologies such as wind, biomass, waste-to-energy or small hydro. Where auctions are held, such as in solar, project developers make their judgement on return expectations, and winning bids in general have been in the low-teens.

Resource base

A number of studies suggest that India's renewable energy resource base is several times higher than the earlier estimates. A Berkeley lab study reckons India's wind potential to range between 2,006 GW and 3,121 GW (for different mast height and site conditions) which is several times the earlier official resource assessment of 48.5 GW.

Furthermore, regulators in some states are offering differentiated FIT to tap low wind zones. The government is exploring options to incentivise repowering. All these steps expand the market potential for renewable energy.

Likewise, solar energy potential estimated by the National Institute of Solar Energy is about 749 GW. This is spread across a wider number of states, viz. Rajasthan (142 GW), Jammu and Kashmir (111 GW), Maharashtra (64 GW), Madhya Pradesh (61 GW), Andhra Pradesh (38 GW) and Gujarat (35 GW).

Offshore wind is another prospect. It is novel elsewhere too (global offshore wind is 8.7 GW) but the industry expects it to grow (180 GW by 2035, IEA forecasts). India seeks to tap its long coastline of 7,600 km for offshore wind, but current candidates are the western coast of Gujarat and southern tip from Rameshwaram to Kanyakumari in Tamil Nadu.

The government has approved a National Offshore Wind Energy Policy which tasks MNRE and NIWE to develop the potential in India's exclusive economic zone. A pilot project of 100 MW is to be set up by select state-owned companies and Suzlon announced a 300 MW offshore wind project in Gujarat. Global players such as Areva, Siemens and GE have voiced plans to explore India's offshore wind power opportunity. A considerable preparatory work remains—to study the wind patterns and sea bed, maritime activities, logistics support, and sea-seismic studies.

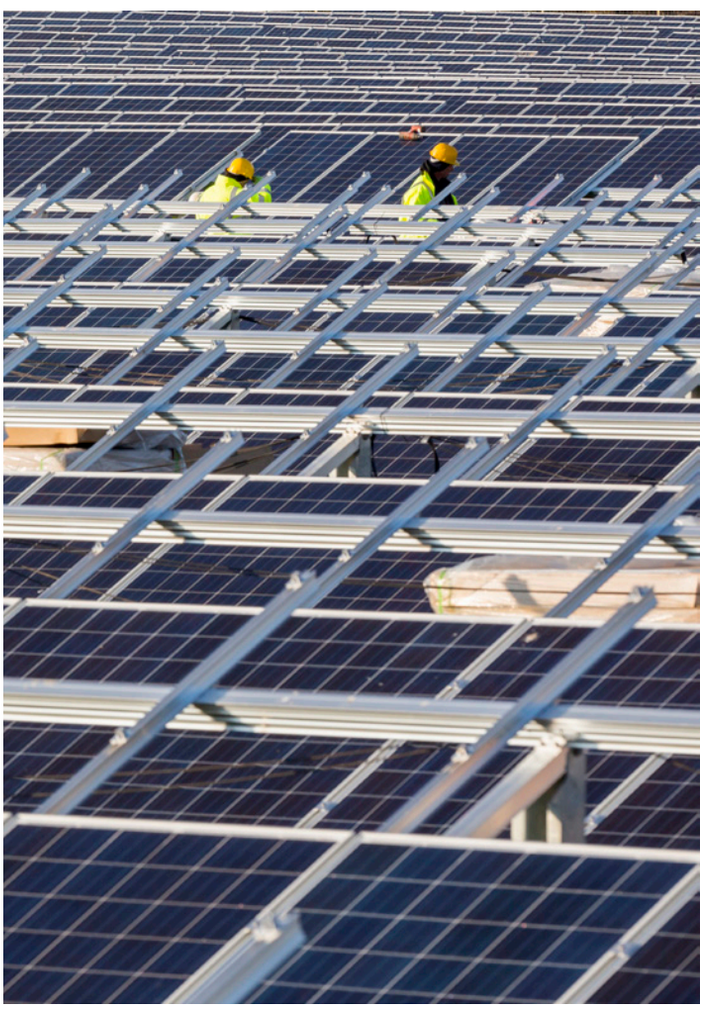
Business models

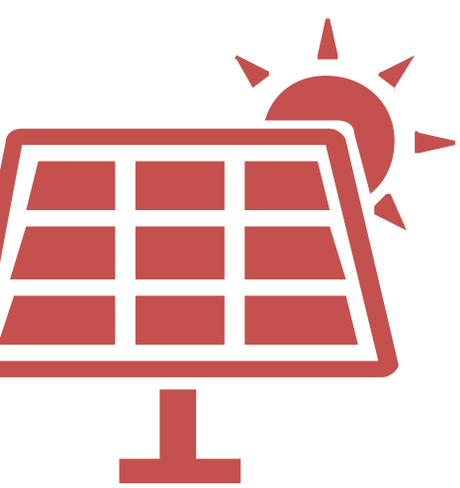
As discussed earlier, India's power market offers renewable energy generators a wide range of options for sale of power—feed-in tariffs, renewable energy certificates, captive and open access sales. This means a wide range of investors can be pursued who then can structure sale contracts that are best suited to their risk-return profile.

The regulatory terms for open access (costs of transmission charges, banking, and cross-subsidy recovery) are pro-renewables and offer a strong cost advantage to benefit generators and buyers of renewable energy. The revised grid arrangements for forecasting and scheduling and levy of imbalance cost provide a clear and realistic path for the development of the renewable industry.

Industry response

The government's market outreach programme—the first Renewable Energy Global Investors Meet and Expo (RE Invest 2015)—attracted wide interest. Domestic private investors expressed interest to develop a total of 190 GW of renewable energy projects, while the state-owned entities committed to develop 18 GW and overseas investors committed to set-up 58 GW. On the manufacturing front, 41 GW of renewable OEM facilities have been proposed. Financial institutions including banks expressed intent to fund renewable energy projects of 72 GW. The government has now initiated consultations with state agencies and the private sector to help translate these active investments. This promises to be an exciting and profitable time to invest in India's renewable energy story.

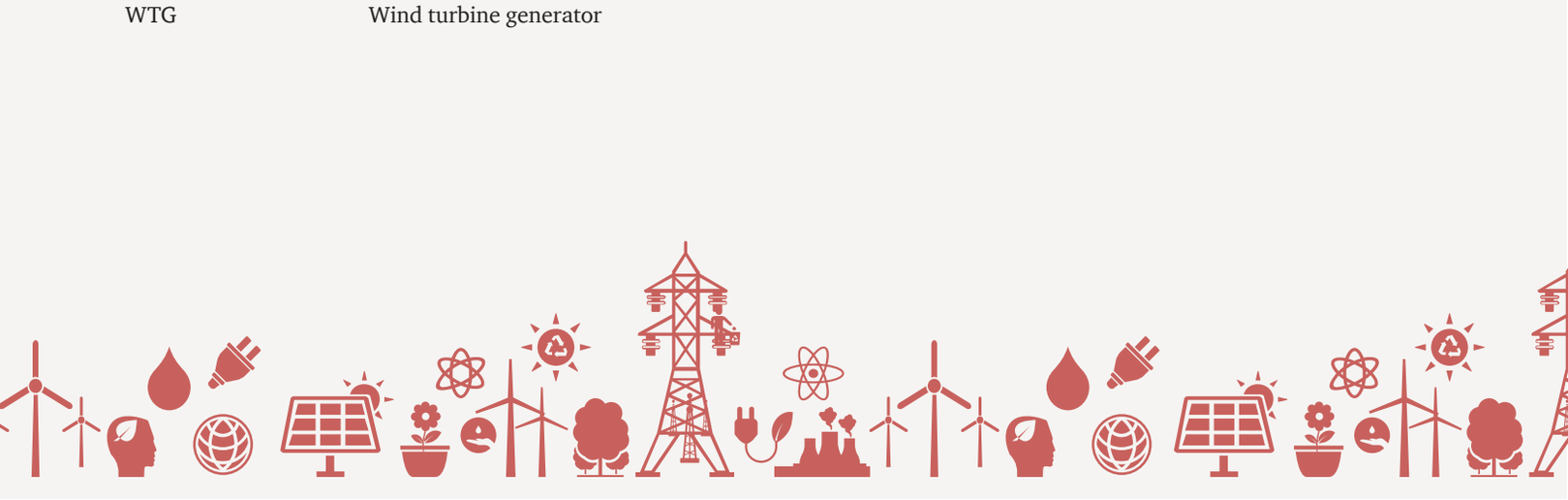




List of abbreviations

AD	Accelerated depreciation
ALM	Asset liability management
AP	Andhra Pradesh
APPC	Average power purchase cost
APTEL	Appellate Tribunal for Electricity
BOO	Build-own-operate
BOS	Balance of system
CAISO	California Independent System Operator
CEA	Central Electricity Authority
CEER	Council of European Energy Regulators
CERC	Central Electricity Regulatory Commission
C-Si	Crystalline silicon
CSS	Cross subsidy
DBFOO	Design-build-finance-own-operate
DBFOT	Design-build-finance-operate-transfer
Discom	Distribution company
DoE	Department of Energy
EC	European Commission
EEG	Erneuerbare-Energien-Gesetz
EPC	Engineering, procurement and construction
ERCOT	Electric Reliability Council of Texas
ESCOs	Energy service companies
EU	European Union
FDI	Foreign direct investment
FERC	Federal Energy Regulatory Commission
FiT	Feed in tariff
FY	Financial year
GBI	Generation-based incentive
GEF	Global Environment Fund
GJ	Gujarat
GW	Gigawatt
GWh	Gigawatt-hour
IEA	International Energy Agency
IEX	Indian Energy Exchange
IESA	India Electronics and Semiconductor Association
KA	Karnataka
km	Kilometre
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt-hour
LCOE	Levellised cost of electricity

MAT	Minimum Alternative Tax
MISO	Midcontinent Independent System Operator
MNRE	Ministry of New and Renewable Energy
MP	Madhya Pradesh
MW	Megawatt
MWh	Megawatt-hour
NIWE	National Institute of Wind Energy
NSM	National Solar Mission
NYISO	New York Independent System Operator
O&M	Operations & Maintenance
OECD	Organisation for Economic Co-operation and Development
OEM	Original equipment manufacturer
p.a.	Per annum
PB	Punjab
PLF	Plant load factor
PPA	Power purchase agreement
PPP	Public private partnership
PV	Photovoltaics
PXIL	Power Exchange India Limited
RE	Renewable energy
REC	Renewable energy certificate
RFP	Request for proposal
RFQ	Request for qualification
RGO	Renewable generation obligation
ROC	Renewable obligation certificate
RPO	Renewable purchase obligation
SERC	State Electricity Regulatory Commission
TF	Thin Film
TS	Telangana
TSO	Transmission system operator
TWh	Terawatt-hour
UI	Unscheduled interchange
UK	The United Kingdom
UP	Uttar Pradesh
US	The United States
USD	United States dollar
VAT	Value-added tax
WTG	Wind turbine generator



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About Mytrah

A pioneer in the renewable energy sector, Mytrah's innovative approach has created a dynamic, cost-efficient power company poised for accelerating growth.

Through a diversified portfolio, it generates maximum amount of electricity from its wind farms using its strong end-to-end capabilities. Mytrah's model enables it to identify, plan and execute projects rapidly and cost effectively, ensuring a sustainable competitive advantage.

Mytrah's fully-integrated project team has delivered 11 sites with a generating capacity of 560 MW across six states in India in only five years. Mytrah currently has an active development pipeline of about 3,500 MW of wind and 500 MW of solar. This will enable continued rapid growth as the company looks to be generating 5,000 MW of renewable energy for India.

Listed on the Alternate Investment Market (AIM) of the London Stock Exchange, Mytrah has access to international capital, expertise and industry partners; it's smart approach positions Mytrah as a progressive force in the global renewable energy sector, delivering sustainable energy without subsidies.

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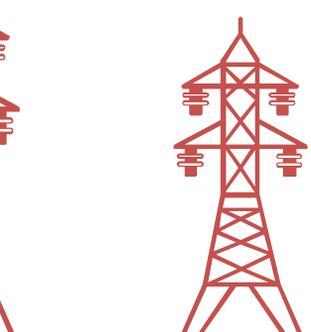

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