Access to Energy

Quarterly Bulletin

ISSN 2278 - 5663 *Vol 4, 2018*

EDITORIAL

Dr. Akanksha Chaurey
CEO, ITP India

Carbon-free regions

William Nordhaus, one of the two Nobel laureates for economic sciences this year, has proven that most efficient remedy for greenhouse gas emissions would be a global scheme of carbon taxes. This is based on his research that compares the consequences of various new policy interventions (such as carbon tax) with that of business-as-usual policies on reducing the carbon emissions. It provides convincing arguments for government interventions for achieving sustained and sustainable global economic growth.

On a related issue, the criticality of government's intervention has been highlighted in addressing the poor air quality of Delhi and surrounding regions. The Indian government's comprehensive anti-pollution Action Plan for the Delhi NCR (National Capital Region) has pushed for time bound actions targeting vehicular emissions, switch to clean fuel options (or closure) for power plants and industries, arresting road and construction dust, monitoring of air quality monitoring etc. The Action Plan is in response to poor air quality of Delhi and surrounding regions.

The cities are at the forefront of climate related risks and many cities world over have made commitments to reduce their carbon footprints. However, they need on-ground solutions that can be implemented to achieve their commitments. A US based think tank recently released a Carbon-free Regions Handbook that helps local governments implement climate policies and actions that would place their communities on an aggressive path towards sustainable low-carbon economies. It lists about 30 actions that cities can take to facilitate a movement towards carbon neutrality. The recommended actions are categorised under 6 broad categories that include- buildings, mobility, electricity, industry, land-use, and waste. It also mentions financing as an overarching sector to facilitate the actions. The focus is clearly on government interventions to address the challenges of climate change.

The work of Paul Romer, who shared the prize with Nordhaus, highlights the power of ideas in achieving growth while limiting environmental costs. The essence of their independent yet complimenting work is that sustainable prosperity is achievable if we enhance the quality of human capital and policy making.

Will India become the next big Asian offshore wind market?

Mark Leybourne
Associate Director
ITPEnergised

Introduction

For at least the last 6 years, the Indian Government has been actively looking at the country's offshore wind potential and developing plans on how to best exploit it.

It is well known that India has an incredibly long coastline but, in reality, there are only a few regions where the offshore winds are practically extractable. The regions with most potential were identified by the EU's FOWIND project which proposed zones within the waters of two states; Gujarat and Tamil Nadu. In principle clearances have been given for 7 of these zones in Tamil Nadu and 6 in Gujarat – some zones were rejected by MoD.

The FOWIND project also provided India with a LIDAR which the National Institute of Wind Energy (NIWE) mounted on a static platform located off the southern coast of Gujarat. This is providing India's first, in-situ, offshore wind measurements and has been operational since October 2017.

In parallel to the FOWIND project, the EU has run the FOWPI project which has the overarching aim of undertaking a FEED study for a 200MW pilot project close to the LIDAR location in Gujarat. This project has; developed a concept design; investigated the metocean, geophysical and geotechnical conditions of the site; and various supporting site surveys have been carried out.

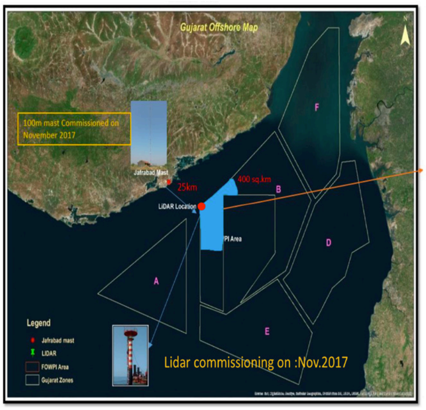
NIWE, a technical body under the Ministry of New and Renewable Energy (MNRE), is acting as the industry coordinator and will play a pivotal role for the sector. Amongst other functions, it will be responsible for facilitating the process of obtaining various clearances and approvals that will be required for projects being developed in India's waters.

In June 2018 MNRE set a target for India to have an installed offshore wind capacity of 5GW by 2022 and 30GW by 2030. This signaled the political intent that is driving this sector and suggests the development of a long-term offshore wind program, rather than a single, pilot project. Whilst some capacity could be operational by 2022, it is highly likely that the target of 5GW will be unachievable as no project has started development - to accelerate this, further development zones should be chosen and wind measurement campaigns started.

Expression of Interest & Draft Tender Document

In April 2018, MNRE published a request for Expressions of Interest (EOI) to develop a 1GW offshore wind project off the coast of Gujarat (see details in Figure 1). Subsequently, 34 parties (a mixture of major international offshore wind developers, wind turbine OEMs, supply chain firms, Indian IPPs etc) submitted EOIs to MNRE. The engagement of large, international firms in the EoI and their willingness to invest in India, signalled significant interest in this market opportunity. Offshore wind developers view India as a potentially large growth market if the policy and regulatory framework can provide the right support.Developers are keen to actively engage with MNRE to help shape the supportive conditions and ensure that the industry has a successful start which benefits them and India.

As part of this developer engagement, MNRE held meetings with 30 investor groups in July 2018 to discuss the proposed development. In parallel, MNRE provided the EOI participants with a draft tender document which laid out MNRE's initial thinking on the tender process for the first project. Whilst this document was a welcome, positive step in the industry's progress, it has highlighted a number of key risks and uncertainties that need to be addressed prior to the tender process commencing.



Site Name	Gulf of Khambhat (Zone –B1) (400 Sq.km)
Taluk/District / State	Jaffrabad/Amerli / Gujarat
Lidar location	20°45'19.10"N , 71°41'10.93"E
Water Depth	-15m (based on NHO* chart)
Distance from coast	23km
Nearest Village	Pipavav
Nearest Town	Jaffrabad
Nearest Railway Station	Rajula Junction
Nearest Airport	Diu
Nearest Port	Pipavav/ Jaffrabad
Nearest Electrical Substations onshore	Ultratech 220kV
CRZ (as per 2011 notification)	Zone IV

Figure 1, Information on the area offered under MNRE's tender for India's first 1GW offshore wind project

Risks & Uncertainties

There are many unknowns and risks currently facing bidders. The following summaries discuss just a few of the major issues;

- **Permits & Approvals:** "Stage 1" clearances have been given for Gujarat's 1GW zone (see Figure 1) – these effectively mean that the most critical central government ministries have no objections (some of the FOWIND zones were objected to by the Ministry of Defence for example). The 1GW zone is however, still waiting initial clearances from some Gujarati stakeholders. There will be many project specific clearances needed for a project and MNRE has identified the main stakeholders that need to give permissions. There is a lack of detail on what exactly will be required, how long these could take and what happens if some approvals are refused or not given in a timely manner. This uncertainty creates high permitting risk.

- **Environmental Impact:** an EIA will be required but there are currently no EIA guidelines or requirements for offshore wind in India (note that EIAs are not typically required for onshore wind). There is a lack of baseline environmental data for the Gujarat site – the intended development timeline will either need to be lengthened to allow sufficient time for surveys, or EIAs will be substandard and lacking in certainty.

- **Subsidies & Tariff:** India has had great success in reducing renewable energy tariffs through the use of auctions. Consequently, tariffs for new onshore wind and PV developments are amongst the lowest in the world. There is an expectation in India that offshore wind tariffs will be at a level similar to those seen in recent European auctions, and a view that future auctions will bring prices down further still. It is currently unknown whether the first project will be affordable (i.e. will central Government be willing to pay prices substantially higher than any other form of electricity generation in India?) and the mechanism that projects will be subsidised.

- **Site Conditions:** By the time of the first offshore wind tender and reverse auction, NIWE will have published one year of offshore LIDAR data and the results of the metocean and seabed surveys undertaken by the FOWPI project. The Gujarati wind resource is low; annual average hub-height speeds are expected to be around 7.5m/s, with conditions being highly dependent on the monsoon winds. Only one year of wind data will be available at the time of bidding meaning that the uncertainty of the long-term wind resource will be high. The soil conditions in Gujarat's waters tend to be low strength and comprised of silty sediments. Furthermore, the FOWPI studies have only concentrated on a 60km^2 area, whereas the area offered for the first project off Gujarat is 400km^2. Whilst the FOWPI surveys will be provided to bidders, there will be no knowledge of ground conditions for the other 340km^2 of the zone. Estimating foundation costs when bidding for a 1GW project will therefore have a large degree of uncertainty.

- **Technology:** The low windspeed conditions at the Gujarat site mean that currently available, European offshore wind turbine models would have low capacity factors and poor economics if they were used. An 8MW class of WTG that is designed for North Sea conditions, for example, will have a low energy yield and not meet MNRE's capacity factor target of 35%. A new model of low wind speed offshore wind turbine will be required to increase energy yield and the performance of a project. Currently, only a few of the leading WTG OEMs are considering developing a turbine for these conditions. The development timeline and certification of these new WTG models may dictate the development and construction timings of India's first projects. Furthermore, these new WTG models and local fabrication will introduce technology risk until they are proven.

- **Timeline:** MNRE intends to run the competition for the first project by the end of 2018. This puts pressure on bidders as little time is available to understand and plan mitigations for local risks. The Indian government will also be under pressure to sufficiently develop the competition process and subsequently evaluate bids. It is expected that the concession rules will also have optimistic time constraints in order to align with India's overarching 2022 offshore wind targets. Time pressures throughout the competition and development process will increase the potential for mistakes to be made.
- **PPA:**It is anticipated that the PPA will take a standard form, used by the Gujarat utilities for the procurement of onshore wind. This will require modification to be suitable for offshore wind projects – the provision of compensation payments in the event of curtailment or grid failures will, for example, need to feature in an agreement. MNRE has stated that the off-taker will be a government body (which reduces the payment risks) but this body has not yet been identified.

Drivers for Offshore Wind in India

India has an optimistic renewable energy target; in April 2018 this was increased to target the delivery of 223 GW of operational renewable electricity generation by 2022. It is worth noting that 2022 has been chosen as the year for the 5GW target as is coincides with India's 75th anniversary of independence – this highlights the importance of political forces that drive the country's intentions. MNRE see offshore wind providing a key contribution to India's future renewable energy mix and anticipate that 35 GW of offshore wind in Gujarat and 30 GW in Tamil Nadu could be feasible. There is still work to do to understand the resource and constraints in both of these states and these figures do not consider the future potential of floating wind which is well suited to the deeper waters of Tamil Nadu. Even if the country's practical resource and conditions allow half of this capacity to be built, this would still be a substantial offshore wind market.

India is heavily reliant on coal generation but there is growing pressure to reduce emissions from coal and improve India's air quality. Further to helping meet India's renewable electricity targets, additional renewable electricity capacity from offshore wind will help to displace coal generation. The development of an offshore wind programme in India would help to increase the country's international profile and demonstrate its ability to deliver high-tech and complex infrastructure projects.

The development of a local supply chain could see India exporting turbines and foundations to other Asian markets, in the same way it is currently doing with onshore turbines. If new, low windspeed, offshore wind turbine models are developed for the Indian market and conditions, these may subsequently be exported to other countries and allow the development of other low offshore windspeed resources. This could open up new offshore wind markets and also improve the economics of others.

Offshore wind could also provide India with a new source of jobs, particularly in the coastal regions of Gujarat, where the declining offshore hydrocarbons sector will eventually impact the viability of local shipyards and ports. This new industry will provide new supply chain opportunities and help to support both existing and new jobs.

Previously, the Indian government, based on understanding of conditions in other more established markets, has considered offshore wind to be too expensive. The recent cost reductions seen in European auctions has interested MNRE and it is felt that India could also play a role in the industry's cost reduction story – particularly if local goods and services can be provided at the right level of quality and cost.

Foreign Direct Investment (FDI) has been a strong driver for many industries in India, including offshore hydrocarbons. Although FDI is not a primary driver for offshore wind, the inevitable involvement of international players within a development consortium will lead to foreign funds flowing into India. Furthermore, the high Indian interest rates mean that foreign financing will be required to help reduce the tariff requirements of projects.

Timeline

The exact timing of the next steps in the competition process is not yet defined. MNRE has stated that the competition for the first project will not begin until one year of LIDAR measurements has been completed. It is likely that the site data package will be released in mid-November 2018. The Solar Energy Corporation of India (SECI) will be responsible for administering the competition and it is anticipated that SECI will release the project RfP at least a month prior to the data being published. The RfP should also include key documentation such as the PPA template, and Ts&Cs for all relevant agreements such as the site lease agreement. Developers will have limited time available to review this documentation and begin bidding preparation. Proposals submitted in response to the RfP will be evaluated by MNRE and NIWE; qualified bidders will then be invited to enter an e-reverse auction to determine the tariff that will be provided for the project.

A Way Forward

India is seeking to implement a competitive allocation process that is inspired by the European approach to offshore wind tendering. The typical European model has been successful in reducing the cost of offshore wind as the government undertakes a large amount of the project development work and reduces the up-front risk to developers. The Government of India has done some of the project development work, mostly through the collection of data, but has not yet done enough to reduce development risk.

This article has demonstrated that there are many fundamental uncertainties surrounding this initial offshore wind tender. Allowing more time before running the tender process and auction would allow many of these issues to be resolved or clarified. This would help to reduce the risk to bidders and could lead to more competition, as some parties would be more comfortable in bidding, and potentially lower tariff prices to be achieved as bidders would place less risk premium on their bids.

If the Danish approach is to be used in future tenders, high quality site data should be collected for the whole zone (including long term wind measurements) prior to bidding. Project permitting should also be undertaken for a project envelope that provides flexibility in a project's design. Alternatively, the government could consider other approaches to the competitive process, particularly those that provide more control to developers. The US approach, for example, allows developers to bid for site concessions through an auction and then subsequently develop a project and compete for a tariff. In the UK, the concession, permitting and tariff elements of a project's development are also split, and although this places more risk on developers, it allows projects to be developed systematically to the developer's requirement. In Taiwan, the government defined allowable areas, but developers were able to also propose their own sites, and in either case the developers are responsible for the project development activities and risks. A key consideration for any competitive process however, is the requirement under Indian policy to bid for a tariff through a reverse auction.

It is important that MNRE continues to engage with bidders ahead of this first tender and that feedback is incorporated into the development of the competition. Many lessons will be learnt through this first bidding round and, where some aspects of the competition need improvement, changes should be made in subsequent rounds; developer feedback will be needed to inform these changes.

Conclusion

There are still many uncertain or undefined elements of the Indian offshore wind competition process. Furthermore, the lack of site data will give a high degree of risk to any developer committing to a deliver a project. Finding the balance between risk and bid price will be challenging, particularly given the competitive pressure to minimise tariff prices. Running a competition with the level of uncertainty currently present will no-doubt lead to high bid prices and there is a further risk that these bid prices may not be acceptable to the Government of India.

That said, there is a strong political will in India for offshore wind to move forward. The development of an offshore wind industry could bring substantial benefits to India through jobs, exports and inward investment. The encouraging involvement of international offshore wind developers shows positive intent to actively develop a new market. The importance of success therefore, goes beyond the contribution of renewable electricity the sector could make. The next 6 months will be critical for the start of this new industry in India and the outcome will determine the future of this potentially large market. If the industry starts with a successful first project, India could quickly develop into Asia's next big offshore wind market.

Towards Sustainable Energy for All in Mozambique: Promoting Market-based Dissemination of Integrated Renewable Energy Systems for Productive Activities in Rural Areas

Flor Clavin
Senior Consultant
ITPEnergised

Mozambique is one of the poorest countries in Africa with only 40% electricity coverage (2014) after making remarkable progress to extend the grid. Biomass meets 78% of the country's energy demand followed by hydropower (9%), oil products (8%), coal (4%) and natural gas (1%). Small farms and agro-food processing industries, which are in most cases located in rural remote areas, face serious challenges in accessing electricity and other forms of modern energy. Most of them have invested in decentralized diesel generators which expose them to oil price fluctuations. There is an estimated 7 GW of RE potential in the country from biomass, solar, wind and mini-hydro resources that could be tapped to increase cleaner energy supply and contribute to a low-carbon development path.

In order to contribute to increase energy access for the population and renewable energy integration for heat and power generation in developing countries like Mozambique, UNIDO provides support for them to apply for GEF grants to conduct projects in this area. ITPEnergised was the consultant hired by UNIDO responsible for the development of all documentation required for the GEF CEO Endorsement approval process.

The full documentation includes energy baseline report, pre-feasibility study reports, full GEF CEO Endorsement document with its corresponding project results framework, detailed activities per component, indicators and monitoring plan, incremental cost matrix for GEF budget, national and global project benefits (environmental, social and gender related), and sources of co-financing. As part of the identification of financing sources, ITPEnergised obtained letters of intent from several co-financiers.

The energy baseline report described the RE potential for each type of resource, identified and characterised the market enablers and identified market barriers such as financial, capacity building, technical, etc. to RE development, as well as illustrated the policy and regulatory framework.

Pre-feasibility studies were conducted for the demonstration projects proposed to be developed under the GEF UNIDO project, involving small to medium scale biogas projects (from cattle manure, cashew shells) for heat and power and solar PV water pumping projects for agriculture irrigation. The technical feasibility parameters such as size, technology, location and others and financial feasibility parameters like IRR, LCOE and sensitivity analysis have been determined too.

Study the impact on bus voltages due to Solar PV penetration in the Low Voltage Distribution Grid

Tanushree Kaul
Senior Consultant
ITP India

Replacing conventional sources of energy completely with renewable energy is going to be a challenging task. However, by adding renewable energy to the grid and gradually increasing its contribution, we can realistically expect a future that is powered completely by green energy…...

Introduction

The use of renewable energy (RE) sources, primarily wind and solar generation, is poised to grow significantly within the Indian power system. The Government of India has announced an ambitious target of 175 gigawatts (GW) of installed RE capacity by 2022 as shown in Figure 1.

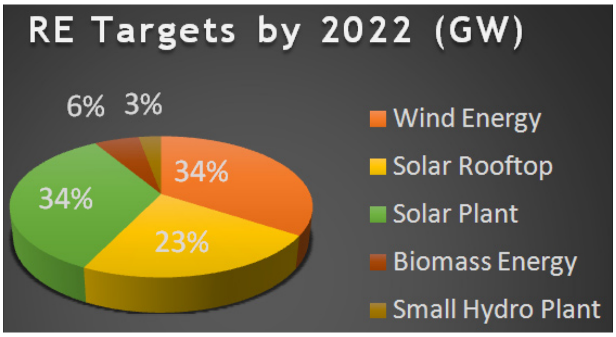


Figure 1: India RE targets by 2022

Electric energy requirement (MU) by 2022 is forecasted to cross 19 Lakh MU (CEA report) in the country. With the target capacity of 175GW by 2022, renewable energy can generate more than 3.4 Lakh MUs which can suffice more than 18% of the energy requirement. This shall however be contingent to efficient grid integration of renewable energy capacity by resolving the various issues like intermittency of RE, non-uniform distribution of RE sources, accurate forecasting and PV penetration limits set by utilities.

A grid integration study is an analytical framework used to evaluate a power system with high penetration levels of renewable energy. Generally, a grid integration study:

1. Simulates the operation of the power system under different RE scenarios;
2. Identifies reliability constraints.

A grid integration analysis was undertaken at one of the low voltage feeders of Andhra Pradesh, India with 6% solar PV penetration to assess the impact of increasing Solar PV penetration onto the voltage levels across the various buses present in the feeder. For assessing the impact, static load flow studies have been carried on the simulation modelling software-MI Power.

Approach

The Single line diagram of the feeder was designed and simulated on the MI power distribution network software for the two different scenarios'. The 1st scenario was taken at the peak load of the day that occurs at night for the selected feeder with no solar PV output at that instance. The 2nd scenario was taken at that instance of the day when there was occurrence of peak; this scenario was simulated with and without the solar PV installed in the feeder. Figure 2 depicts the load pattern of the feeder on 16th May 2017, which was considered for carrying out the simulation studies. In general, it has been observed that the maximum solar output can be obtained during 12:00 noon to 3:00 P.M. so, to analyse the impact during the day time scenario power output at 13:00 hrs has been considered i.e. 1.4 MW. The peak for the day was 2.06 MW at 23:00 hrs.

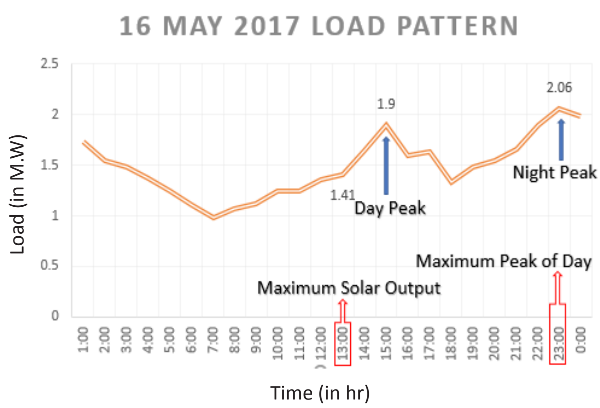


Figure 2: Load pattern of one of the feeders of Andhra Pradesh, India

Analysis & Results

1. Base Case scenario: It represents the actual condition i.e. without making any change in level of solar PV penetration actually feeding into the grid, location of the PV in the grid etc. It was observed that during night peak, both the active and reactive power losses was approximately 43.74 kW & 68.25 kVAR respectively. But in case of day load with PV, both the power losses have been reduced by almost 3% in kVAR value and 2% in kW value. Then to further check the effect of connected PV into the grid, the scenario 2 was developed in whichthe penetration level of PV was increased from its actual value.

2. Scenario 2: In this case thesolar PV penetration in the grid was increased from 10%to 80%. Then the analysis is carried out in terms of both the power losses and the voltages across the buses in the grid in per unit (P.U) system. It was observed that the active and reactive power loss has been reduced almost by 68% to 76% and 62% to 80% respectively considering the 10% to 80% penetration levels.

While analyzing the voltages at various buses it has been observed that when the penetration level was increased, at 80% penetration the voltage limits was violated. According to the technical standards the voltage limits should lie between 0.95 P.U and 1.05 P.U which in our case at one of the bus was 1.0512 P.U at 80% as shown in figure 3. So, it can be analysed that the level of penetration can be increased more than 80%. Even the parameters like harmonics levels, short circuit currents etc. (beyond the scope of this study) could get impacted with increase in the level of penetration into the grid.

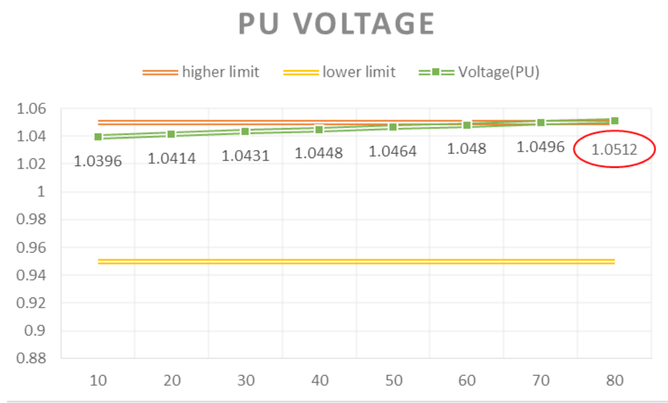


Figure 3: Voltages at varying penetration level at one of the bus

Conclusion

This scope of this study is not only limited to the integration of the solar PV but can be used for other RES as well. The results obtained through these studies will help to build confidence among policymakers, system operators, and investors to move forward with plans to increase the amount of RE on the grid.

The above article is based on the author's Internship report, submitted in 2017 to the National Power Training Institute, Faridabad, India.

ITPEnergised Offices

Bristol
ITPEnergised
29 Great George Street
Bristol, UK BS1 5QT
T: +44 (0) 117 214 0510
E: info@itpenergised.com

Edinburgh
ITPEnergised
7 Dundas Street
Edinburgh, UK EH3 6QG
T: +44 131 557 8325
E: info@itpenergised.com

Glasgow
ITPEnergised
The Whisky Bond
60 Elliot Street,
Glasgow, UK G38DZ
T: +44 (0) 131 557 8325
E: info@itpenergised.com

London
ITPEnergised
10 Bloomsbury Way
Holborn, London, WC1A 2SL
T: +44 (0)20 3700 6111
E: info@itpenergised.com

Mainland Europe
ITPEnergised
Lisbon, Portugal
T. +351917208573
E: info@itpenergised.com

Latin America
ITPEnergised
Buenos Aires, Argentina
T: +54 11 3750 9853
E: americas@itpowergroup.com

China
IT Power China
Beijing
T: +86 10 6413 6295
E: china@itpowergroup.com

Australia & Pacific
ITP Renewables / ITP
Thermal, Canberra
T: +61 2 6257 3511
E: info@itpau.com.au

New Zealand
ITP Renewables
Auckland
T: +64 275 818 989
E: admin@itpau.com.nz

Published by:

IT Power Private Limited
410, Ansal Tower, 38 Nehru Place
New Delhi – 110019, INDIA
Tel: +91 (11) 4600-1191/92
Fax: +91 (11) 4600-1193
Web: www.itpower.co.in
Email: info@itpower.co.in