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EDITORIAL



With more and more renewable energy penetration in India specially with higher wind power contribution, we need to lean towards smart grid technologies to allow larger penetration of wind power and to exploit its full potential for on-grid/off-grid applications of wind

turbine generators. This will enable several millions of Indian population to have access to electricity in either grid connected or distributed generation mode

Smart Grid Week 2012 Meeting being planned in January 2012, India is already one of the twelve members of International Smart Grid Consortium (ISGC), it is only apt to high light Indian efforts towards utilization of smart grid technologies by way of setting up an Indian Smart Grid Task Force/ (ISGTF) and a forum called Indian Smart Grid Forum (ISGF) by none other than Ministry of Power.

What this Smart Grid Technologies can bring to the electricity generation, distribution and delivery system? With the merger of Integrated Communication and Information Technology, an electricity delivery system from point of generation to point of consumption including variable rates of billing is facilitated through smart grid. As per the vision of smart grid in India, in line with Ministry of Power is envisaging (i) end of load shedding, (ii) reliable & cheaper power, (iii) shifting the peak away from costly power and finding more (iv) sustainable power, for all. This envisages that India requires 100,000 MW of additional generation capacity in the next six years, Electricity sector investment is expected at over \$400b (USD) in the same time period, with 2,500 MW of renewable power will be added to India's grid every year.

Towards penetration of renewable power, Ministry of New & Renewable Energy (MNRE) has initiated a parallel activity for possible adaptation of smart grid technology.

C-WET is all set to develop further to ensure the industry to expand the wind power potential of the Country. C-WET's R&D Unit has completed the Rotor blade development through the joint project with NAL, Bangalore. As part of the R&D, on Human Resource Development (HRD) a capacity building action has been initiated at PSG College of Technology, Coimbatore. In spite of limited number of small wind turbine models, C-WET is doing rigorous testing as per the IEC-61400-2 standards, to assure both performance as well as safety.

Amidst several Wind Resource Consultancies and value added services, C-WET is also planning a complete reassessment of wind potential at higher hub heights beyond 50 meters (viz. at 80 meters and above) through a fast track project to measure wind resources using 100 meter anemometry at 75 locations spread all over India.

Testing Unit has a busy schedule with number of agreements signed for new testing in addition to the Inter Lab Comparison studies under the C-WET-NREL, USA MoU, with strict adherence to quality systems of ISO 9001:2008 & ISO/IEC 17025:2005. An equipment inventory management system has been developed to monitor instrument/sensor deployment in various WTG measurement project and is under testing.

Periodical release of RLMM list by the Certification group has been continuing its services to the Industry in addition to the review of Indian Standards on wind turbines circulated by Bureau of Indian Standards.

ITCS Unit has completed 11th National Training Course and 8th International Training Programme during February 2012. There have been several visitors to the Campus from various Colleges and Schools.

The Solar Radiation Resource Assessment (SRRA) which is executing the mission mode project has completed installation and commissioning of all the 51 automatic solar radiation monitoring stations which are transmitting through GPRS to the central receiving station at C-WET. The processed monthly data are regularly uploaded on C-WET's website since May 2011.

Some activity has been initiated by Hybrid Wind Systems (HWS) Unit, which was started since September 2011 at C-WET to promote renewable energy in various educational institutions.

Most of the Scientists were also quite busy in delivering invited and keynote addresses in their respective specialization during this period.

It is requested that the readers of PAVAN should interact with the Scientists concerned of C-WET and come out with research proposals/studies or projects that could be undertaken by C-WET with more detailed involvement of the Industry and the stake holders. Your constructive criticism and suggestions for improvement of PAVAN C-WET are welcome as ever.

S. Gomathinayagam
Executive Director

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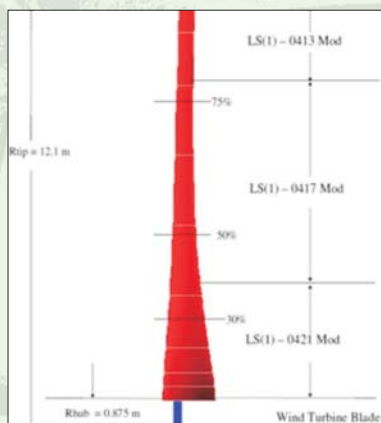
Developments in R&D UNIT

Development and validation of design methodologies and design tools to enable wind turbine rotor / blades to be optimized for low and moderate wind regimes

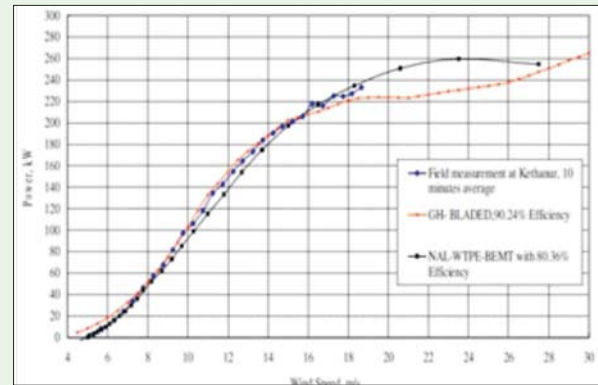
R&D unit had initiated a project in close association with NAL, Bangalore. The project has reached its conclusion. NAL was successful in developing a fully indigenous design methodology for developing rotors specifically for low and moderate regimes. The design methodology has been checked out on a candidate 300 kW wind turbine rotor and additional 300 kW wind turbine blades were fabricated and field tested on an available wind turbine platform.



Test Turbine at Kethanur field measurements



Rotor developed for 300 kW Turbine



Power improvement in the 300 kW Turbine

In addition a wind augmentation device – gurney flap has also been investigated. NAL has used the design methodology to design a 500 kW NMITLI HAWT with gurney flaps and field tested the turbine at Kethanur wind farm, Coimbatore district. The project was technically completed and closed.

HRD Project - Capacity Building in Wind Energy

HRD is one of the key areas where industry is facing hardship in getting the trained technician / qualified personnel particularly for O&M of wind turbine for its expected design life of 20 years. R&D unit of C-WET has initiated and sponsored courses in two colleges. One of the beneficiaries is PSG College, Coimbatore. Three certificate courses of 6 months duration and two post graduate diploma courses of 9 months duration were sponsored by C-WET at PSG College of Technology and the courses were initiated in January 2011. The first batch of students has graduated and many have been absorbed by the industry and the 2nd batch course will commence on the 30th of December 2011.

Testing of Small Wind Turbine at WTRS

The unit is presently in the process of analyzing the data acquisitioned during the Type Testing of seven small wind turbines of 1.4 kW, 3.2 kW, 3.5 kW, 4.2 kW, 5 kW and 5.1 kW ratings at the Wind Turbine Research Station, Kayathar as per the requirements of IEC - 61400-2 together with IEC 61400-12-1. Based on the results of analysis, the test reports will be prepared in consultation with Small Wind Energy Systems (SWES) Empanelment committee constituted by MNRE.





Small Wind Turbines Testing is in progress

Move on in WRA UNIT

Nine new wind monitoring stations, 4 in Andhra Pradesh, 5 in Kargil (Jammu & Kashmir) have been established during the period from October to December 2011. Presently, 98 wind monitoring stations are in operation in 20 States and one Union Territory under various wind monitoring projects funded by the Ministry of New and Renewable Energy as well as various entrepreneurs.

Projects on Verification of procedure of wind monitoring have been completed for the following sites

- Shethvadala for M/s. Suzlon Infrastructure Services Ltd, Pune.
- Khirsara, Vadgam, Atmakuru, Raketla for M/s. Suzlon Energy Ltd, Pune.
- Mandsaur for M/s. Enercon (India) Ltd, Mumbai.
- Anehalu for M/s. NMDC Ltd, Hyderabad.
- 56 sites in Maharashtra for M/s. Maharashtra Energy Development Agency, Pune.

The following consultancy projects has been completed and submitted the reports

Site Validation & Generation Estimation of existing:

- 10.5 MW wind farm project at Anehalu, Chitradurga district in Karnataka for M/s. NMDC Limited, Hyderabad.
- 66 x 1.5 MW wind farm project at Poolavadi in Tamil Nadu & Proposed 33 x 1.5 MW wind farm project at Dalot, Pratapgarh District in Rajasthan for M/s. Regen Powertech Private Limited, Chennai.



Wind profile measurement by using LIDAR at WTTS/WTRS, Kayathar

Meeting

Meeting of "WRA project including 100 m anemometry" has been conducted on 29th November 2011 at C-WET, Chennai. Representatives from SNAs have been participated.



Review Meet in progress

Steps forward in TESTING UNIT

An agreement was signed between C-WET and M/s. Jyoti Ltd for Type Testing of WIND JYOTI – SE 850 – 56 / 70 kW wind turbine on 11th October 2011 at WTTS, Kayathar.

Continuous measurements and load calibration are under progress for the Type testing of 250-T wind turbine of M/s. Shriram EPC I & II at Pavor Chathiram, Tenkasi, Tamil Nadu.



Instrumentation at site in progress

Continuous measurements and load calibration are under progress for the Type Testing of GARUDA 700 kW wind turbine at Melamaruthappapuram Village, in (SF.N.141/5) V. K. Pudur Taluk and Tirunelveli District, Tamil Nadu.

Inter Laboratory Comparison (ILC) on Power Curve Measurements as per the requirements of IEC 61400-12-1 between C-WET and NREL USA completed on 11th November 2011. The ILC is a part of the MoU signed between C-WET and NREL, USA on the 23rd November 2009.



Instrumentation at factory in progress

Quality system as per the requirements of ISO 9001:2008 and ISO/IEC 17025:2005 are being maintained on a continuous basis through audits and corrective actions.

An Equipment Database Management System has been developed and is currently under testing and vulnerability assessment

This database management tool will assist in the maintenance of the details regarding history, storage, calibration transportation and deployment of all sensors / transducers and data acquisition systems.



Screen shot of the Login page

The system will be deployed in the C-WET's website and will be accessed from anywhere through strict security protocols by the testing unit.

Marching ahead in S&C UNIT

- RLMM Addendum – I list to the "MAIN LIST dated 22nd June 2011", finalized by RLMM Committee has been issued on 26th September 2011.
- Further to issue of RLMM Addendum – I list dated 26th September 2011 to the "MAIN LIST dated 22nd June 2011", the process for issue of Appendix has been initiated.
- Review / verification of documentation / information obtained from various wind turbine manufacturers have been completed.
- Organized RLMM Committee meeting and "Appendix to the RLMM Addendum – I list dated 26th September 2011", finalized by RLMM Committee, has been issued on 30th November 2011.
- Continuous support has been provided to the Software Consultant in connection with testing of the RLMM online software.
- Review of draft Indian Standards on Wind turbines circulated by Bureau of Indian standards are under progress.
- The continual improvement and maintaining the Quality Management System are ongoing.

Highlights from ITCS UNIT

Eleventh National Training Course

ITCS Unit had successfully organized 11th National Training Course on "Wind Energy Technology" during 28th to 30th December 2011 with an objective to provide basic knowledge on wind turbine technology and to provide a platform to exchange

views & experience with wind energy experts. The course was inaugurated by Prof. Dr. C. P. Vendhan, Emeritus Professor, Ocean Engineering Department of IIT Madras, Chennai.



C.P.Vendhan inaugurating the course

The programme has provided comprehensive knowledge right from Wind Resource Assessment to Installation & Commissioning of wind farms along with technical and financial challenges. In the programme, 93 participants have participated. The participants have been from dynamic mix of background, developers, manufacturers, academicians, utilities, SNAs etc. The course was highly appreciated by the participants for its content and the way of organization.



Participants in front of C-WET Campus

The lectures were delivered by C-WET Scientists, National Industry and Academic experts. Prof. Dr. S. K. Bhattacharya, Head, Ocean Engineering department of IIT Madras, Chennai was the Chief Guest for the valedictory function and distributed the course certificate to the participants.



S. K. Bhattacharya distributing the course certificate

Future Training Programmes Eighth International Training Course

A 4-week fully sponsored international training course on "Wind Turbine Technology and Applications" specially for African Countries is scheduled during 1st to 24th February 2012 by C-WET, which is sponsored by Ministry of External Affairs (MEA), Government of India and supported MNRE.

The objective / aim of this training program is to transfer knowledge and special skills related to wind energy to the specialists active in technical and operational field. The idea is to provide specialized training and knowledge to industry, utilities, technical institutions and various governmental implementing agencies. Moreover the course will provide an invaluable platform for dialogue and open exchange of views and experiences.

Ninth International Training Course

Detailed proposal has been prepared to organize the 9th International Training course during September 2012 under ITEC/SCAAP programme of MEA with the support of MNRE.

C-WET's Annual Report

C-WET Annual Report for the year 2010 – 11 has been prepared covering detailed activities of all the units of C-WET and printed. The reports have been forwarded to MNRE to place it on the tables of the Parliaments.

OTHER ACTIVITIES

The Information, Training and Commercial Services (ITCS) unit was engaged with full of activities, executing training programmes, upgrading the infrastructure for good research environment in C-WET by providing IT & Training facilities and also reaching out to the public as well as industries to promote wind energy in the country. The unit also, manages library, collects information for Newsletters, update websites and maintains IT infrastructure. The unit ensures e-security in the campus by regular monitoring and taking proactive steps.

Visitors to the Campus

During the period from October to December 2011, the following visits were arranged. A brief presentation were made about basic wind energy and C-WET activities with services for student visitors and the campus facilities were also showcased. The visitors were students, delegates from foreign countries and stakeholders.

- 26 participants from 12 countries of LIFE Academy, Sweden International Training course has visited C-WET campus on 18th October 2011 and Wind Turbine Testing Station, Kayathar on 23rd October 2011.
- 60 Students of 3rd Semester Mechanical Engineering from VIT University, Chennai on 5th October 2011.
- 88 students from Electronics & Instrumentation Engineering Department along with 3 staff members of Hindustan Institute of Technology and Science, Padur on 9th December 2011.

Advances in SRRA

Realizing the importance of accurate ground measured solar radiation data, MNRE is implementing Solar Radiation Resource Assessment (SRRA) project to set up and operation of a countrywide data collection system on solar radiation and meteorological parameters, in selected identified potential areas. All the 51 Automatic Solar Radiation Monitoring Stations have already been installed, completed and commissioned in 11 states. The data pertaining to solar radiation and meteorological parameters are sampled @10 second and averaged for 10 minutes and transmitted through GPRS to the Central Receiving Station at C-WET. Processed monthly data are regularly uploaded on C-WET website since May 2011.

Sensor or system calibration is directly related to the data validity. The calibration of radiation sensors which are working in the field site is carried out by comparing it against a standard or against a set of standards. A calibration laboratory has been established at C-WET to generate a set of secondary standards against which the instruments at field stations are going to be calibrated.

Spearheading in HWS

The concept of Hybrid Wind Systems (HWS) has generated sufficient interest in various educational institutions. Almost 30 nos of such system proposals have been forwarded to MNRE for assistance during this financial year. The input data from these institutions on existing load & power consumption pattern has been received and examined against the average wind velocities of the respective locations (about 40 mt height above GL). Based on data, the load was matched to the size of the system and the information has been communicated to the institutions.

With reference to Non – Solar Hybrid Systems, the location survey in Karnataka is being undertaken by Barathiya Agro-industries Federation (BAIF), the necessary action will be put in place as and when the information receives us.

Invited lecture delivered by C-WET Scientists in external forums

Dr. S. Gomathinayagam Executive Director, C-WET

- Key Note Address in the International Conference on Wind Energy Trends & Issues WETI-2011, NITTTT, Bhopal on 12th October 2011.
- Discussion at CSIR-SERC, Chennai on NMITLI project review-meeting on "The next generation wind power technology: Contra-Rotor Wind Turbine (CRWT) system" on 3rd November 2011.

- 12th Plan Clean Energy Plan at Secretariat, Government. of Tamil Nadu on 28th October, 2011 and in Sub Group Committee on Wind at Tamil Nadu Energy Development Agency (TEDA) on 4th November 2011
- VII Executive Committee of Centre for Energy Studies at Anna University on 8th November 2011.
- Invited Panelist from India, for NREL -IRENA workshop in Renewable Energy Technology during 21-23 November 2011 in Golden, Colorado in USA.
- Industrial Exemption Committee meeting by Land Reforms Dept, Tamil Nadu Government on 2nd December 2011.
- Invited panelist Power Summit-2011 Wind Session on "Vision to Reality-65.2 GW Wind power installed by 2020" at New Delhi conducted by Bloomberg UTV.
- Doctoral Committee Meeting (Ph. D) for Shri. P. Saravanan at Madras Institute of Technology Campus, Anna University on 17th December 2011.

Wind Resource Assessment

Dr. E. Sreevalsan, Scientist & Unit Chief

- Presented a paper on "Identifying optimal wind zones across the country and applying the appropriate level of R&D to ensure cost-effective power generation" at RENEWCON India Conference 2011 held at Mumbai on 29th September 2011.
- Group discussion on the topic of "Wind Resource Assessment - An Indian Experience" in Dhaka, Bangladesh in a workshop sponsored by USAID / SARI / Energy on "Wind Power Project Development Practical Approaches to Launching Sustainable wind projects" on 17th - 20th October 2011.
- Work shop on "Action plan for Comprehensive renewable energy development in Tamilnadu" organized by WISE, Pune" at Narmada Hall, Hotel Courtyard Marriott, Chennai on 18th November 2011.
- "Wind Resource Assessment" for PG Diploma-WRA students in Amrita Vishwa Vidyapeetham, Coimbatore on 24th November 2011.

Shri. K. Boopathi, Scientist

- Invited as a Chief Guest for Technical Symposium STROKE 2011 and presented a paper on "Emerging Trends in Wind Energy at Arulmigu Meenakshi Amman College of Engineering, Kanchipuram on 23rd September 2011.

Wind Turbine Testing

S.A. Mathew, Scientist & Unit Chief

- Selected as a member for Technical Committee for the International Conference on Green Technology & Environmental Conservation (GTEC-2011) held during 15th to 17th December, 2011 in association with Tamil Nadu Pollution Control Board (TNPCB), NSWAI and ISWA organized by Sathyabama University and evaluated the

technical papers received from Sathyabama University for presentation and publication during the conference.

- "Wind Energy Grid Integration" held on 12th October, 2011 at TNEB office, Chennai organized by TNEB and PR & DC.

M.Anvar Ali, Scientist

- "Wind Energy Grid Integration" held on 12th October, 2011 at TNEB office, Chennai organized by TNEB and PR & DC

Standards & Certification

S. Arulselvan, Junior Engineer

- "Wind Turbine Technology" at International Conference on "Renewable Energy Technologies", jointly organized by Solar Energy Society of India, Coimbatore local chapter and Department of Electrical & Electronics and School of Energy, PSG College of Technology, Coimbatore in association with W2E, USA.

Information, Training & Commercial Services

P.Kanagevel, Scientist & Unit Chief (i/c)

- "Overview of the Development of Renewable Energy in India" at Hotel Raj Park Chennai, on 17th October 2011 for International Training Course participants organized by LIFE Academy, Sweden

- "World Wind Energy Research Growth Analysis: A Scientometric Study" at the 2nd International Conference on Wind Energy: Trends & Issues (WETI-2011) organized by National Institute of Technical Teachers' Training & Research (NITTTR), Bhopal during 12th to 14th October 2011.

Solar Radiation Resource Assessment

Dr. G. Giridhar, Scientist & Unit Chief

- 'Brainstorming Meet on the Establishment of National Centre for Atmospheric Technology on 12th December 2011 at NIOT, Chennai.
- Inter solar meet on 'Indian Solar Thermal market- Policies and Incentives' on 13th December 2011 at Mumbai.
- "Solar Energy Applications" in the workshop on "Global Solar Water Heating Market Transformation and Strengthening Initiative: India Country Program" held at Madurai on 16th December 2011.

Prasun Kumar Das, Scientist

- "International Congress on Renewable Energy 2011" at Tezpur University, Assam organized by Solar Energy Society of India during 2nd to 4th November 2011 and presented a paper on "Correlations of Monthly Mean Daily Diffuse radiation for North-East India".

The following staffs delivered lecture(s) in the 11th National Training course on "Wind Energy Technology" held during 28th – 20th December 2011 at C-WET.

No	Title	Speakers
1	Wind Energy Conversion Technology and Power Generation & Wind Turbine Tower Concepts	Dr. S. Gomathinayagam Executive Director, C-WET
2	Wind Resources Assessment & Siting	Dr. E. Sreevalsan Scientist & Unit Chief, WRA
3	Wind Turbine Components	K. Boopathi Scientist, WRA
4	Design Aspects of Drive Train	J. C. David Solomon Scientist, R&D
5	Wind Electric Generators & Types	M. Anvar Ali Scientist, WTT
6	Control and Safety System of Wind Turbine System	S. Arulselvan Junior Engineer, S&C
7	Wind Turbine Foundation Concepts & Small Wind Turbines and Hybrid Systems	Rajesh Katyal Scientist & Unit Chief, R & D
8	Grid Generation of Wind Turbines	Deepa Kurup Scientist, R & D
9	Role of C-WET in Wind Energy Development	P. Kanagavel Scientist & Unit Chief (i/c), ITCS
10	Wind Turbine Testing	S. A. Mathew Scientist & Unit Chief, WTT
11	Type Certification of Wind Turbines	A. Senthil Kumar Scientist & Unit Chief, S&C
12	Indian Government Policies	Mohammed Hussain Scientist & Unit Chief, WTRS



Upcoming Events 2012

- 3rd International Wind Conference and Exhibition (WE20 by 2020)
- On 5th – 7th February 2012 at CODISSIA Trade Fair Complex, Coimbatore, Tamilnadu.
- International Conference Expo on Renewable Energy, on March 12th & 13th 2012 at Chennai Trade Centre, Nandambakkam, Chennai, Tamilnadu.



Wind Power Potential in India-Assessment at 100 m level

As per the Indian Wind Atlas, installable wind power potential has been estimated as 49 GW at 50 m agl with the assumption of 2% land availability (as land assessment was not a part of the Wind atlas preparation, the assumption was made as per the results of micro survey studies done for a few stations in the country) in the wind farm potential area and of course, this is the most conservative reference scenario of assessment and these details are made clear in the Indian Wind Atlas. Regarding the Tamilnadu wind power potential, C-WET has estimated 5374 MW at 50 m agl with 2 % land availability. Tamilnadu's present installed capacity has crossed 6000 MW. However, everyone should notice one important point that out of 6000 MW more than 4000 MW has been installed at above 50 m agl. Unfortunately without noticing this fact many people including researchers used to criticize the estimation of C-WET not only in the conferences but also in their research papers.

As the current technology brings up the wind turbine of higher hub heights in the range of 80-120 m, and also land use pattern is not considered in previous assessment it is necessary to know the potential at higher hub height level with the details of actual land availability. Potential can be described in different scenarios. The 'moderate' scenario takes into account all existing or planned policy measures and also the advantages of modern wind turbines in terms of it's new heights, rotor diameters and overall efficiency. In that case Indian wind power potential might be more than 100 GW at 80 m level and relevant maps are made available in Indian Wind Atlas book. As per the most 'ambitious' scenario it could go even more than this figure. However the actual resources and land availability have to be assessed and validated with the actual measurements and land surveys.

The estimated potential with 2% and 6% land availability for seven states without any validation may be given as indicated in the following Table.

Sl. No	State	Potential with 2 % land availability GW	Potential with 6 % land availability GW
1	Andhra Pradesh	14	42
2	Gujarat	35	105
3	Karnataka	14	42
4	Maharashtra	6	18
5	Madhya Pradesh	12	36
6	Rajasthan	5	15
7	Tamilnadu	14	42

In these circumstances it is proposed to conduct a realistic assessment considering tangible land availability for wind farming for seven wind potential states namely Tamilnadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, Gujarat and Rajasthan at 100 m level facilitating validation of meso scale based results indicated in the Wind Atlas. Ministry has launched a reassessment programme with 100 m anemometry to validate the potential at 100 m level in seven potential states including the land assessment. This project will have following objectives.

1. Preparation of Micro scale Wind atlas for 100 m level with a spatial resolution of 200 m - 1000 m using existing Numerical wind atlas (lib file) of the country with the cross checking of observed Wind Climate files made available through the existing surface wind measurements data. The raw or meteorological potential of the country will also be estimated at this stage.
2. Estimation of technical potential at 100 m level: GIS techniques will be used to assess the land availability and estimate technical potential.
3. Validation of the above results with actual measurements (100 m Anemometry) and estimate the real technical potential.
4. Micro level – Investment grade potential assessment: Detailed Wind Energy maps for selected sites. This will be done after reviewing the results of third phase. Project will be started current financial year (2011-12).

Project duration will be three years.