o/c

adani™

APSEZ/EnvCell/2017-18/042 **Date:** 22.11.2017

To

Additional Principal Chief Conservator of Forests (C),
Ministry of Environment, Forest and Climate Change,
Regional Office (WZ), E-5, Kendriya
Paryavaran Bhawan, Arera Colony,
Link Road No. – 3, Bhopal – 462 016.
E-mail: rowz.bpl-mef@nic.in

Sub : Half yearly Compliance report for Environment and CRZ Clearance for the "Multi Product SEZ, Desalination, Sea Water Intake, Outfall Facility and Pipeline at Mundra, Dist. Kachchh, Gujarat of M/s. Adani Ports and SEZ Limited"

Ref : Environment and CRZ clearance granted to M/s Adani Ports and SEZ Limited vide letter dated 15th July, 2014 bearing MoEF letter No. 10-138/2008-IA.III.

Dear Sir,

Please refer to the above cited reference for the said subject matter. In connection to the same, it is to state that copy of the compliance report for the Environmental and CRZ Clearance for the period of April – 2017 to September – 2017 is enclosed here for your records. The stated information is also provided in form of a CD (soft copy).

Thank you,
Yours Faithfully,
For, **M/s Adani Ports and Special Economic Zone Limited**

Ennarasu Karunesan
Chief Executive Officer
Mundra & Tuna Port

Encl: As above

Copy to:

1) The Director (IA Division), Ministry of Environment, Forests & Climate Change, Indira Paryavaran Bhawan, Jor Bagh Road, New Delhi-110003
2) Zonal Officer, Regional Office, CPCB – Western Region, Parivesh Bhawan, Opp. VMC Ward Office No. 10, Subhanpura, Vadodara – 390 023
3) Member Secretary, GPCB – Head Office, Paryavaran Bhavan, Sector 10 A, Gandhi Nagar – 382 010
4) Deputy Secretary, Forests & Environment Department, Block – 14, 8th floor, Sachivalaya, Gandhi Nagar – 382 010
5) Regional Officer, Regional Office GPCB (Kutch-East), Gandhidham, 370201

कार्यालय OFFICE
Ministry of Environment & ... (केन्द्रीय)
क्षेत्रीय कार्यालय (...
Regional Office (West ...
भोपाल (म.प्र.)–462 ...

Adani Ports and Special Economic Zone Ltd
Adani House
PO Box No 1
Mundra, Kutch 370 421
Gujarat, India

Tel +91 2838 25 5000
Fax +91 2838 25 5110
info@adani.com
www.adani.com

adani

Environmental Clearance Compliance Report

Multi Product SEZ, Mundra, Dist. Kutch, Gujarat

Adani Ports and SEZ Limited

For the period of

April–2017 to September–2017

Index

adani	Adani Ports and Special Economic Zone Limited, Mundra.	From : April,17 To : September,17
Status of the conditions stipulated in Environment and CRZ Clearance		

Copy of Environmental and CRZ Clearance

F. No. 10-138/2008-IA.III
Government of India
Ministry of Environment & Forests

Paryavaran Bhawan,
CGO Complex, Lodhi Road,
New Delhi - 110 003.

Dated: July 15, 2014

To
M/s Adani Port and SEZ Ltd
Adani House, Near Mithakhali Six Roads,
Navarangpura, Ahmedabad,
Gujarat- 380 009.

Subject: EC for proposed Multi- Product SEZ and CRZ clearance for Desalination, sea water intake, outfall facility and pipeline, at Mundra by M/s Adani Port and SEZ Ltd. – Reg.

This has reference to letter No. ENV-10-2010-1601-E dated 27.03.2012 of the Director (Environment) & Additional Secretary, Govt. of Gujarat and your subsequent letters dated 10.05.2012, 14.05.2012, 26.05.2012 and 29.04.2013 seeking prior Environmental and CRZ Clearance for the above project under the EIA Notification, 2006 and Coastal Regulation Zone Notification, 2011. The proposal has been appraised as per prescribed procedure in the light of provisions under the EIA Notification, 2006 and the Coastal Regulation Zone Notification, 2011 on the basis of the mandatory documents enclosed with the application viz., the Questionnaire, EIA, EMP, recommendations of the State Coastal Zone Management Authority and the additional clarifications furnished in response to the observations of the Expert Appraisal Committee constituted by the competent authority in its meetings held on 16th –17th April, 2012, 4th –5th June, 2012 and 9th -10th July, 2012.

2. It is, interalia, noted that the project involves development of multi product SEZ on a plot area of 18,000 ha. of which 6641.2784 ha. is presently notified under Special Economic Zone (SEZ). As per the proponent, the Multi product SEZ at Mundra comprising of various processing zones, non-processing zones, warehousing zones, Road Network (trunk as well as internal), Bridges or culverts over natural drains, Rail Network, IT-Telecommunication network, Electrical Network, Water supply, conservation & drainage Network, Effluent collection network, Desalination Plant with proposed intake & outfall locations, Common Effluent Treatment Plants & Sewage Treatment Plants, Natural Gas line network, Social Infrastructure, Existing Airstrip, Municipal Solid Waste Disposal site, utilities & supporting infrastructure etc. For the first phase of development total water requirement will be 150 MLD. Power requirement will be approx. 360 MW. Desalination plant of 150 MLD output capacity is proposed. 11 MLD water will be sourced through Narmada water pipeline. Two CETP each of capacity 50 MLD and 17 MLD as well as STP of 62 MLD is proposed. This will require 375 MLD of seawater intake and 241 MLD of treated waste water outfall into the sea. For final phase of development total water requirement will be 450 MLD and power requirement will be approx. 1000 MW.

3. A suitable seawater intake point has been identified on the eastern end of the approved East Port Basin at Latitude 22°48'30.76"N; Longitude 69°46'34.06"E where a depth of 6 m below CD would be available after the port development. As per modelling study the combined discharge of 241MLD which includes 16MLD from CETP and 225 MLD from desalination plant as RO reject is expected having 57.57ppt of salinity, 14.41 mg / l of BOD and 94.39 mg/l of COD. After careful consideration of many aspects a suitable outfall location is identified on the west of the Eastern basin at Latitude 22°46'44.04"N; Longitude 69°45'5.51"E taking advantage of the expected 7.5m below CD basin depth. The outfall pipe line length is approximately 5.7 km and diffuser designed to attain a minimum dilution of 40-50 times.

4. The Centre for Earth Science Studies demarcated HTL, LTL and CRZ area. As per the CESS report and GCZMA, out of 6641.2784 ha of SEZ area, 1473.39 ha area falls within CRZ area. No SEZ industrial activity is proposed in the CRZ area. Only the Desalination plant pipeline for intake and outfall is proposed in CRZ areas. The Gujarat SCZMA in their 14th meeting held on 27-02-2012 considered the proposal of intake, outfall facilities, Desalination plant and laying pipeline and recommended the same vide their letter no.ENV-10-2010-1601-E dated 27th March 2012. Gujarat Pollution Control Board has granted Consent to Establishment of Marine outfall (NOC) vide letter dated 10.11.2011. The length of the intake will be approximately 5 Kms. As the sea water intake demand is 15000m3/h, drawal by pipe system is suitable by incorporating a wet well structure at the location. The intake point proposed is within the proposed East Port basin with a depth of 6 m below CD. The projected quantity of water can be transported through a single pipe of 1.3 m dia with a flow velocity of 3 m/ s or with a 1.6 m pipe with flow velocity of 2m/s.

5. The Expert Appraisal Committee, after due consideration of the relevant documents submitted by the project proponent and additional clarifications furnished in response to its observations, have recommended for the grant of Environment and CRZ Clearance for the SEZ in an area of 8481.2784 ha. However, SEZ for 1840 ha has been approved in principle by Ministry of Commerce and Industries.

6. Hon'ble High Court of Gujarat in WP No. 21 of 2013 vide order dated 13.01.2014 has directed that the Ministry to take a decision of its own so far as the issue of grant of environmental clearance is concerned considering the position prevailing as on date and also the aspects which have been highlighted by us in this judgment, within a period of thirty days from the date of this judgment without fail. Further, vide order dated 27.01.2014 Hon'ble Supreme Court in SLP No. 1526 of 2014 which was filed against the Order of High Court by the Respondent-1 has passed order that in case, the MOEF is unable to complete the process within the time stipulated by the High Court, it will be open for them to approach this Court for extension of time. Accordingly, Ministry has filed a petition before the Hon'ble Supreme Court seeking extension of two months time.

7. It is noted from the Judgement dated 13.01.2014 of Hon'ble High Court of Gujarat in PIL 21 of 2013 the Hon'ble Court has construed the grant of lease to units prior to

obtaining EC by M/s APSEZL as violation of EIA, Notification, 2006. Therefore, according to the OMs dated 12.12.2012 and 27.06.2013, PP was addressed for Board Resolution and the State Government was addressed to take credible action against the PP for the violation. Direction under Section 5 of E(P)Act, 1986 was also issued to APSEZ not to take up and allow any further construction activity within SEZ till the grant of clearance.

8. Further, Hon'ble Supreme Court video order dated 02.05.2014 in SLP 1526 of 2013 had ordered for stay of Ministry's letter dated 3.04.2014 addressed to Government of Gujarat to initiate legal action for the violation, also directed that the Ministry to complete the process of EC within eight weeks.

9. M/s APSEZ Ltd. has stated that the Board resolved that since the matter is sub-judice before the Hon'ble Supreme Court of India, will fully abide by the out come of the decision of the Hon'ble Supreme Court.

10. In view of the above and to comply with the orders of Hon'ble Courts, Ministry hereby accords necessary Environment Clearance for proposed Multi- Product SEZ in an area of 6641.2784 ha and CRZ clearance for desalination, seawater intake, outfall facility and pipeline for as per the provisions of Environmental Impact Assessment Notification – 2006 and its subsequent amendments and Coastal Regulation Zone Notification, 2011, subject to strict compliance of the terms and conditions as follows:

11. PART A - SPECIFIC CONDITIONS

(i) *PP shall abide by the final order/decision of Hon'ble Supreme Court in SLP (Civil) no. 1526/2014 and connected matters.*

(ii) *Properly conserve the creeks, river and the mangroves area in the area.*

(iii) *Ensure that mouths of all the creeks are kept open to ensure flushing of the creeks.*

(iv) *Bring the creeks to the condition as was seen in the satellite map of 2005 which will be a "reference" satellite map and a copy of which shall be sent to you separately.*

(v) *Submit once in a year latest satellite map which can be compared with the reference satellite map of 2005 to ensure that no modification in the creeks, rivers, mangroves and mouth of creeks have taken place.*

(vi) *Any direction issued by the MoEF with respect to the report submitted by Ms Sunita Narain Committee shall be complied with by the Proponent as applicable.*

(vii) *At its cost get Inspection study done once in a year by the organizations like NEERI or any organization approved by this Ministry to - (i) ensure compliance of all the EC conditions (ii) development of SEZ meeting of the environment norms, and (iii) advise any mid-term correction that can be introduced depending on the recommendation of the independent Third Party.*

(viii) *"Consent for Establishment" for the SEZ shall be obtained from Gujarat Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.*

(ix) *PP shall get detailed bathymetry done for all the creeks and rivers within Port and SEZ areas along with mapping of co-ordinates, running length, HTL, CRZ boundary, mangrove areas including buffer zone through NCSCM / NIOT. PP shall also get prepared a detailed action plan for conservation and protection of creeks/ mangrove area etc through NCSCM / NIOT and submit the same to GCZMA for their examination and recommendation. GCZMA will submit its recommendations to MoEF for approval.*

(x) *PP shall demarcate the CRZ area on land with GPS coordinates in consultation with GCZMA/ the agency which has done the HTL/LTL demarcation for the area. There shall be no allotment of plot/s in CRZ area to industries. No industrial activity within CRZ area except the port and harbor & the foreshore facilities shall be allowed as committed*

(xi) *Till the approval of action plan for conservation and protection of creeks/ mangrove area, the CRZ area within SEZ shall be demarcated as "No Development Zone". PP shall not allow/ undertake any development in CRZ area of SEZ.*

(xii) *The implementation of action plan approved by the MoEF shall be monitored by the NCSCM/ NIOT. Compliance with action plan shall be submitted to GCZMA and to MoEF, RO. at Bhopal along with six monthly monitoring report.*

(xiii) *PP shall earmark separate budget for the implementation of the above action plan. The details of the expenditure shall be submitted to GCZMA and to MoEF, RO. at Bhopal along with six monthly monitoring report.*

(xiv) *All the industry in SEZ shall be connected through impervious drainage lines to the STP/ CETP for the discharge of their sewage or industrial effluent. There shall not be any discharge to creeks / rivers. PP shall be accountable for implementing this condition and necessary clause shall be incorporated in the MoU while allotting the plot to the individual industries*

(xv) *PP shall not carry out any river course modification.*

(xvi) *The individual industrial units shall obtain prior EC under EIA Notification, 2006 as applicable.*

(xvii) *Proponent shall identify 200 ha of land for mangrove plantation as per the condition laid by SEAC.*

(xviii) *50 meter buffer from the existing mangrove area should be provided for any developmental activity,*

(xix) *Proponent shell develop the green belt with 3 layers of canopy all along the periphery.*

(xx) *All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.*

(xxi) *There shall be no disturbance to the sand dunes. The pipelines shall be laid using advanced method viz. Horizontal Directional Drilling (HDD) so as to avoid disturbance to the sand dunes/ creeks/ mangroves.*

PART – B. GENERAL CONDITIONS

Construction Phase.

(i) *Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.*

(ii) *A First Aid Room will be provided in the project both during construction and operation of the project.*

(iii) *All the topsoil excavated during construction activities should be stored for use in horticulture/landscape development within the project site.*

(iv) *Disposal of muck during construction phase should not create any adverse effect on the neighbouring communities and be disposed, taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.*

(v) *Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contaminants.*

(vi) *Construction spoils, including bituminous material and other hazardous materials, must not be allowed to contaminate watercourses and the dump sites for such material must be secured so that they should not leach into the ground water.*

(vii) *Any hazardous waste generated during construction phase should be disposed off as per applicable rules and norms with necessary approvals of the Gujarat Pollution Control Board.*

(viii) *The diesel generator sets to be used during construction phase should be low sulphur diesel type and should conform to Environment (Protection) Rules prescribed for air and noise emission standards.*

(ix) *The diesel required for operating DG sets shall be stored in underground tanks and if required, clearance from Chief Controller of Explosives shall be taken.*

(x) *Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards and should be operated only during non-peak hours.*

(xi) *Ambient noise levels should conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase. Adequate measures should be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB/GPCB.*

(xii) *Fly ash should be used as building material in the construction as per the provisions of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003. (The above condition is applicable only if the project site is located within 100 Kms of Thermal Power Stations).*

(xiii) *Ready mixed concrete must be used in building construction.*

(xiv) *Storm water control and its re-use should be regulated as per CGWB and BIS standards for various applications.*

(xv) *Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other referred best practices.*

(xvi) *Permission to draw ground water shall be obtained from the competent Authority prior to construction/operation of the project.*

(xvii) *Separation of grey and black water should be done by the use of dual plumbing line for separation of grey and black water.*

(xviii) *Fixtures for showers, toilet flushing and drinking should be of low flow either by use of aerators or pressure reducing devices or sensor based control.*

(xix) *Use of glass may be reduced by upto 40% to reduce the electricity consumption and load on air-conditioning. If necessary, use high quality double glass with special reflective coating in windows.*

(xx) *Roof should meet prescriptive requirements as per Energy Conservation Building Code by using appropriate thermal insulation material to fulfill requirements.*

(xxi) *Opaque wall should meet prescriptive requirement as per Energy Conservation Building Code which is proposed to be mandatory for all airconditioned spaces while it is aspirational for non-airconditioned spaces by use of appropriate thermal insulation material to fulfil these requirement.*

(xxii) *The approval of the competent authority shall be obtained for structural safety of the buildings due to earthquake, adequacy of fire fighting equipments, etc. as per National Building Code including protection measures from lightning etc.*

(xxiii) *Regular supervision of the above and other measures for monitoring should be in place all through the construction phase, so as to avoid disturbance to the surroundings.*

(xxiv) *Under the provisions of Environment (Protection) Act, 1986, legal action shall be initiated against the project proponent if it is found that construction of the project has been started without obtaining environmental clearance.*

Operation Phase

(i) *The PP while issuing the allotment letter to individual member units shall specifically mention the allowable maximum quantity of water usage and effluent generated by each member unit.*

(ii) *The PP shall establish an environmental monitoring cell with all the potential polluting units as members to review the environmental monitoring data and suggest improvements.*

(iii) *Treated affluent emanating from STP shall be recycled/reused to the maximum extent possible. Treatment of 100% grey water by decentralised treatment should be done. Discharge of unused treated affluent shall conform to the norms and standards of the Pollution Control Board. Necessary measures should be made to mitigate the odour problem from STP.*

(iv) *The solid waste generated should be properly collected and segregated. Wet garbage should be composted and dry / inert solid waste should be disposed off to the approved sites for land filling after recovering recyclable material.*

(v) *Diesel power generating sets proposed as source of back up power for elevators and common area illumination during operational phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Low sulphur diesel should be used. The location of the DG sets may be decided in consultation with the Gujarat Pollution Control Board.*

(vi) *Noise should be controlled to ensure that it does not exceed the prescribed standards. During night time the noise levels measured at the boundary of the building shall be restricted to the permissible levels to comply with the prevalent regulations.*

(vii) *Green belt of adequate width and density preferably with local species along the periphery of the plot shall be raised so as to provide protection against particulates and noise.*

(viii) *Weep holes in the compound walls shall be provided to ensure natural drainage of rain water in the catchment area during the monsoon period.*

(ix) *Rain water harvesting for roof run- off and surface run- off, as plan submitted should be implemented.*

(x) *The ground water level and its quality should be monitored regularly in consultation with Central Ground Water Authority.*

(xi) *Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided. Parking should be fully internalized and no public space should be utilized.*

(xii) *A Report on the energy conservation measures conforming to energy conservation norms finalised by Bureau of Energy Efficiency should be prepared incorporating details about building materials & technology, R & D Factors etc and submitted to the Ministry along with six monthly monitoring report.*

(xiii) *Energy conservation measures like installation of CFLs/TFLs for the lighting the areas outside the building should be an integral part of the project design and should be in place before project commissioning. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/ rules of the regulatory authority to avoid mercury contamination. Solar panels may be used to the extent possible.*

(xiv) *Adequate measures should be taken to prevent odour problems from solid waste processing plant and STP.*

(xv) *The buildings should have adequate distance between them to allow movement of fresh air and passage of natural light, air and ventilation.*

(xvi) *The environmental safeguards contained in the EIA Report should be implemented in letter and spirit.*

(xvii) *Adequate drinking water facility be provided.*

(xviii) *Incremental pollution loads on the ambient air quality, noise and water quality should be periodically monitored after commissioning of the project.*

(xix) *Application of solar energy should be incorporated for illumination of common areas, lighting for gardens and street lighting in addition to provision for solar water heating. A hybrid system or fully solar system for portion of the apartments should be provided.*

(xx) *Ozone depleting substance (Regulation & Control) Rules should be followed while designing the air conditioning system of the project.*

12. Officials from the Regional Office of MOEF, Bhopal who would be monitoring the implementation of environmental safeguards should be given full cooperation, facilities and documents / data by the project proponents during their inspection. A complete set of all the

documents submitted to MoEF should be forwarded to the CCF, Regional office of MOEF, Bhopal

13. In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry.

14. The Ministry reserves the right to add additional safeguard measures subsequently, if found necessary, and to take action including revoking of the environment clearance under the provisions of the Environmental (Protection) Act, 1986, to ensure effective implementation of the suggested safeguard measures in a time bound and satisfactory manner.

15. All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.

16. These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and control of Pollution) act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification, 2006.

17. The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Clearance and copies of clearance letters are available with the Gujarat Pollution Control Board and may also be seen on the website of the Ministry of Environment and Forests at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bhopal.

18. Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.

19. "Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010".

20. A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.

21. The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

22. The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.

23. The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.

(Lalit Kapur)
Director (IA-III)

Copy to:

1. The Principal Secretary, Forest and Environment Department, Block no. 14/ 8 floor Sachivalaya, Gandhinagar – 382 010 Gujarat.
2. The Chairman, Central Pollution Control Board, Parivesh Bhavan, CBD-cum-Office Complex, East Arjun Nagar, Delhi – 110 032.
3. The Member Secretary, Gujarat Coastal Zone Management Authority & Director,(Environment) Forests & Environment Department, Block No. 14, 8th Floor, Sachivalaya, GandhiNagar-382.
4. The Chief Conservator of Forests, Ministry of Environment and Forests, Regional Office, Western Region, Kendriya Paryavaran Bhavan, Link Road No. 3, Ravishankar Nagar, Bhopal – 462016 (M.P.)
5. The Member Secretary, Gujarat State Pollution Control Board, Paryavaran Bhawan , Sector 10-A, Gandhi Nagar 382043, Gujarat
6. Director (EI), Ministry of Environment and Forests.
7. Guard File.
8. Monitoring File.

(Lalit Kapur)
Director (IA-III)

adani	Adani Ports and Special Economic Zone Limited, Mundra.	From : April,17 To : September,17
Status of the conditions stipulated in Environment and CRZ Clearance		

Compliance Report of Environmental and CRZ Clearance

M/s. APSEZ has been granted Environmental / CRZ clearance vide letter no. 10-138/2008-IA.III, dated 15th July, 2014 for development of "Multi Product SEZ, Desalination, Sea Water Intake, Outfall Facility and Pipeline".

Activities / Facilities approved are as below:

Facilities / Components Approved	Capacity	Status as on 31.03.2017
Desalination Plant	150 MLD	Construction has not been started.
Sea water Intake & Outfall Facility	375 MLD: Intake 241 MLD: Outfall	Construction has not been started.
Common Effluent Treatment Plant	17 MLD	MPSEZ Utilities Pvt. Ltd. (MUPL) has been granted environmental clearance for CETP having 17.0 MLD capacity. Out of which at present one module of CETP having 2.5 MLD capacity has been constructed and is in operation.
	50 MLD	Construction has not been started.
Social Infrastructure Projects	--	Adani Mundra SEZ Infrastructure Pvt. Ltd. (AMSIPL) has granted environmental clearance for township and area development project in 255 Ha.
Sewage Treatment Plant	62 MLD	APSEZ has installed Sewage Treatment Plant @ 150 KLD Capacities within SEZ for treatment of sewage generated from port user buildings.
Airstrip	--	Airstrip has been developed within SEZ area after obtaining requisite permissions.
Municipal Solid Waste Site	--	Material Recovery site is provided for the management of Municipal Solid Waste.
Free Trade & Ware House Zone (FTWZ)	--	Construction work is under progress.

List of Industrial Units within SEZ area

Sr. No.	Name of Unit	Nature of Business	Status
1	SKAPS INDUSTRIES	Textile	Operation
2	TERRAM EOSYNTHETICS	Textile	Operation
3	AHLSTROM	Textile	Operation
4	ASHAPURA GARMENTS	Textile	Operation
5	THERMAX	Textile	Operation
6	OWS	Ware House	Operation
7	DORF KETAL	Chemical	Operation
8	OCCL	Chemical	Operation
9	AADI OIL	Oil	Operation
10	GARG TUBES LLP	Steel	Operation
11	EMPEZAR LOGISTICS	Ware House	Operation
12	SEABIRD CFS	CFS	Operation
13	HONEYCOMB CFS	CFS	Operation
14	ALL CARGO CFS	CFS	Operation
15	MUNDHRA CFS	CFS	Operation
16	SAURASHTRA CFS	CFS	Operation
17	FORBES CFS	CFS	Operation
18	TRANSWORLD CFS	CFS	Operation
19	MICT CFS	CFS	Operation
20	MSTPL (Mundra Solar Technopark Pvt. Ltd.)	Electronics Manufacturing Cluster	Operation
21	STEINWEIGE	FTWZ	Operation
22	INDEV LOGISTIC	FTWZ	Construction work completed
23	BRITANNIA INDUSTRIES LIMITED	Food Products	Under construction

Note:

Environmental / CRZ clearance has been granted for additional facilities like Processing Zones, Non-processing Zones, Warehousing Zones, Road Network (Trunk as well as Internal), Bridges or Culverts over natural drain, Rail Network, IT-Telecommunication Network, Electric Network, Water Supply, Conservation & Drainage Network, Effluent Collection Network and Utilities & Supporting Infrastructure within SEZ area.

Boundary wall is constructed along the project periphery. In some of areas level raising and area development of SEZ area, wherever required is also under progress.

Half yearly Compliance report of Environment Clearance for the project "Multi Product SEZ" and CRZ Clearance for the project "Desalination, Sea Water Intake, Outfall Facility and Pipeline at Mundra, Dist. Kachchh, Gujarat of M/s. Adani Ports and SEZ Limited" vide MoEF letter No. 10-138/2008-IA.III dated 15th July, 2014

Sr. No.	Conditions	Compliance Status as on 30-09-2017
Part – A: Specific Conditions		
i.	PP shall abide by the final order/decision of Hon'ble Supreme Court in SLP (Civil) no. 1526/2014 and connected matters.	Point noted and will be complied.
ii.	Properly conserve the creeks, river and the mangroves area in the area.	Complied. All creeks are in existence allowing free flow of water and there is no filling or reclamation of any creek area. APSEZL has so far constructed 19 culverts having total length of approx. 1100 m with total cost of INR 20 Crores. Three RCC Bridges have been constructed over Kotdi creek with total length of 230 m and cost of INR 10 Crores. Photographs of the same are attached as **Annexure – 1**. NCSCM has carried out detailed study on mapping of creeks in the Mundra region for 2017 which confirms the same. A copy of the said progress report is attached as **Annexure – 2**. 1254 ha area identified as potential mangrove conservation is being conserved and there is no disturbance to the mangroves in this area. A monitoring report prepared by GUIDE was submitted along with last half yearly compliance report Oct'16 to Mar'17. Recent report of NCSCM 2017 confirms the presence of 2265 Hectare mangrove area. NCSCM study progress report is attached as **Annexure – 2**.
iii.	Ensure that mouths of all the creeks are kept open to ensure flushing of the creeks.	Complied. As per Marine EIA of WFDP in 2008 carried out by NIO, prominent creek system (main creeks and small branches of creeks) in the study region are: (1) Kotdi (2) Baradimata (3) Navinal (4) Bocha (5) Mundra (Oldest port (Juna Bandar) leading to Bhukhi river).

Sr. No.	Conditions	Compliance Status as on 30-09-2017
		All above creek mouths are open allowing free flow of water in to the creeks and surrounding areas and there is no filling or reclamation of any creek area. The same can be confirmed from the recent study being carried out by NCSCM. Please refer **Annexure – 2** for further details. Please refer specific condition no. ii above for further details.
iv.	Bring the creeks to the condition as was seen in the satellite map of 2005 which will be a "reference" satellite map and a copy of which shall be sent to you separately.	Complied Based on the final direction issued by MoEF&CC vide their letter dated 18th Sept. 2015, APSEZ has submitted a letter vide our letter dated 23.05.2016. As per the directions of MoEF&CC these conditions stand null & void. Copy of direction letter and our letter submitted to MoEF&CC was submitted along with last compliance submission for the period from Oct'16 to Mar'17.
v.	Submit once in a year latest satellite map which can be compared with the reference satellite map of 2005 to ensure that no modifications in the creeks, rivers, mangroves and mouth of creeks have taken place.	
vi.	Any direction issued by the MoEF with respect to the report submitted by Ms Sunita Narain Committee shall be complied with by the Proponent as applicable.	Complied. Based on the report submitted by Sunita Narain committee and subsequent correspondences, MoEF&CC issued an order vide letter dated 18.09.2015 containing 10 directions and thereby disposed-off the show cause notices. A detailed compliance report for the same is attached as **Annexure – B**.
vii.	At its cost get Inspection study done once in a year by the organizations like NEERI or any organization approved by this Ministry to - (i) ensure compliance of all the EC conditions (ii) development of SEZ meeting of the environment norms, and (iii) advise any mid-term correction that can be introduced depending on the recommendation of the	Complied. Compliance report of Multi Product SEZ EC and CRZ clearance was submitted to senior official of NEERI. Based on the site visit as well as the said compliance report NEERI has given their feedback and no non-compliance is observed. So far, INR 10 Lacs are spent for the said study. NEERI has been appointed to carry out the inspection study up to the year 2020 at a cost of INR 12 Lacs. Correction measures / recommendations suggested, if any, by NEERI in this regards will be discussed and

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	independent Third Party.	implemented.
viii.	"Consent for Establishment" for the SEZ shall be obtained from Gujarat Pollution Control Board under Air and Water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	Complied. Consent to Establish (CtE) is obtained for the project from Gujarat Pollution Control Board vide their letter no. GPCB/CCA-KUTCH-1044/ GPCB ID 31463/ 109800, dated 16.04,2012. Copy of the same is already submitted with compliance submission for the period from Oct'15 to Mar'16. APSEZ has been granted Consent to Operate (CtO) from GPCB for common infrastructure facilities developed vide Order No. AWH-88998, dated 26.10.2017. Copy of the same is attached as **Annexure – 3**.
ix.	PP shall get detailed bathymetry done for all the creeks and rivers within Port and SEZ areas along with mapping of co-ordinates, running length, HTL, CRZ boundary, mangrove area including buffer zone through NCSCM/NIOT. PP shall also get prepared a detailed action plan for conservation and protection of creeks/mangrove area etc through NCSCM/NIOT and submit the same to GCZMA for their examination and recommendation. GCZMA will submit its recommendations to MoEF for approval.	Being complied This reply covers condition no. ix to xiii. APSEZ approached National Center for Sustainable Coastal Management (NCSCM), Chennai to carry out the studies as stated in these directions. Upon initiation of the study, a progress report with detailed scope of work and action plan was submitted to all concerned authorities as part of the compliance report for the period Oct'16 to March'17. Further, NCSCM has carried out all necessary site surveys and based on the findings, mathematical modelling using computer software is going on. The 2nd progress report is attached as **Annexure – 2** Further progress will be submitted upon completion of the study. Cost of the study as per the NCSCM proposal is 315.5 Lakh and 90% of the payment against the same is already made as an advance.
x.	PP shall demarcate the CRZ area on land with GPS coordinates in consultation with GCZMA/ the agency which has done the HTL/LTL demarcation for the area. There shall be no allotment of plot/s in CRZ area to industries. No industrial activity within CRZ area except the port and harbor & the foreshore	

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	facilities shall be allowed as committed.	
xi.	Till the approval of action plan for conservation and protection of creeks/mangrove area, the CRZ area within SEZ shall be demarcated as "No Development Zone". PP shall not allow/undertake any development in CRZ area of SEZ.	
xii.	The implementation of action plan approved by the MoEF shall be monitored by the NCSCM/NIOT. Compliance with action plan shall be submitted to GCZMA and to MoEF, RO at Bhopal along with six monthly monitoring report.	
xiii.	PP shall earmark separate budget for the implementation of the above action plan. The details of the expenditure shall be submitted to GCZMA and to MoEF, RO at Bhopal along with six monthly monitoring report.	
xiv.	All the industry in SEZ shall be connected through impervious drainage lines to the STP/CETP for the discharge of their sewage or industrial effluent. There shall not be any discharge to creeks / rivers. PP shall be accountable for implementing this condition and necessary clause shall be incorporated in the MoU while allotting the plot to the individual industries.	Complied. As per the MoUs signed, all existing industries are well connected with impervious pipeline to discharge their effluent / sewage after confirming to the inlet norms of CETP. Entire quantity of treated water is being utilized for horticulture purpose in SEZ area. No discharge is allowed in to creeks / rivers. Same practice will be continued in future as well and capacity enhancement of CETP will be carried out on need based assessment. Please refer **Annexure – 4** for listed member units of CETP with respect to wastewater management.
xv.	PP shall not carry out any river course modification.	Complied No river course modification is carried out.
xvi.	The individual industrial units shall obtain prior EC under EIA Notification, 2006 as	Complied. During the compliance period of Apr'17 to Sep'17, no new

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	applicable.	industry has been established at SEZ which requires EC under EIA Notification, 2006. The condition is being followed on case to case basis as applicable.
xvii.	Proponent shall identify 200 ha of land for mangrove plantation as per the condition laid by SEAC.	Complied. 100 Ha. Mangrove plantation is carried out by SAVE at Tala Tadav village of Khambhat Taluka of Anand district. A final report of SAVE is attached as **Annexure – 5.** 100 Ha. Mangrove plantation is being carried out by GEC at Tala Tadav village of Khambhat Taluka of Anand district.
xviii.	50 meter buffer from the existing mangrove area should be provided for any developmental activity.	Point noted and complied. All developmental activities are being carried out as per the approval only.
xix.	Proponent shall develop the green belt with 3 layers of canopy all along the periphery.	Complied. APSEZ has developed its own "Dept. of Horticulture" which is taking measures/ steps for terrestrial greening as well as mangrove plantation. Development of greenbelt at various locations within the SEZ is an ongoing activity. Green belt of 3 layer canopy will be developed as part of the development of SEZ. The species such as Ficus Infectoria, Ficus religiosa, Terminalia arjuna, Cocos nucifera, Washingtonia fillifera, Casurina spp., Azadirachta Indica, Eucalyptus spp., Jatropha curacus, Ficus bengalensis, Subabool spp., Casia fistula, Date Palm and Delonix regia were grown in SEZ area. Width of the green belt varies from 2 m to 8 m and density from 2000 to 2500 trees per hectare. Total 99.5 hectares of land with approx. 2.2 Lacs trees is developed under SEZ area till date. So, far APSEZ have developed more than 400ha. area as greenbelt with plantation approx. 7.7 Lacs saplings within the APSEZ area. Please refer **Annexure – 6** for further details regarding greenbelt development and mangrove afforestation and

Sr. No.	Conditions	Compliance Status as on 30-09-2017
		updated green belt development plan is attached as **Annexure – 7**. Total expenditures of the horticulture dept. for this compliance period are INR 554 lakh.
xx.	All the recommendation of the EMP shall be complied with in letter and spirit. All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF-RO.	Complied. Compliance report of environmental management plan and mitigation measures proposed as part of the EIA repot is attached as **Annexure – 8.**
xxi.	There shall be no disturbance to the sand dunes. The pipelines shall be laid using advanced method viz. Horizontal Directional Drilling (HDD) so as to avoid disturbance to the sand dunes/creeks/ mangroves.	Complied. There is no sand dune in the SEZ area. Point noted. No pipelines for intake and outfall of sea water are laid till now and feasibility will be studied as and when required.
Part – B: General Conditions		
	Construction Phase	
i.	Provision shall be made for the housing of construction labour within the site with all necessary infrastructure and facilities such as fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creche etc. The housing may be in the form of temporary structures to be removed after the completion of the project.	Complied. Most of the construction labours reside in the nearby villages where all basic facilities are easily available. However, for those residing near the construction site, infrastructure facilities such as water supply, drinking water, toilets, STP, sanitation, first aid, ambulance etc. is made available by APSEZ. Photographs showing dignity of labour are shown in **Annexure – 10**.
ii.	A first aid room will be provided in the project both during construction and operation of the project.	Complied. APSEZL has already available Occupational Health Center & First Aid facility, which will be utilized during entire construction as well as operation phase of SEZ project. Whereas in case of emergency situation requiring treatment at hospital facility, same will be

Sr. No.	Conditions	Compliance Status as on 30-09-2017
		provided at Adani Hospital located with SEZ area.
iii.	All the topsoil excavated during construction phase should be stored for use in horticulture/landscape development within the project site.	Complied. Excavated topsoil is used for the horticulture/landscape development within the project site.
iv.	Disposal of muck during construction phase should not create any adverse effect on the neighboring communities and be disposed, taking the necessary precautions for general safety and health aspects of people, only in approved sites with the approval of competent authority.	Complied. APSEZ adopt 5R concept for environmentally sound management of different types of solid & liquid waste. Liquid Effluent & Sewage - It is being treated at ETP/STP plants, treated water from ETP/STP is being used for horticulture purposes in compliance with GPCB standards. Municipal Solid Waste APSEZ have established Material Recovery Facility for environmentally sound management of Dry Solid Waste within port. Presently manual sorting is being done for sorting of different types of solid waste, sorted out different stream of recyclable material is being sent to recycling like Paper, Plastic, Cardboard, PET Bottles, Glass etc., whereas remaining non-recyclable waste is bailed and sent to cement plant for Co-processing as RDF (Refused Derived Fuel). Dry & wet waste is segregated at the source of generation, by which all wet waste (Organic waste) is being segregated & utilized for compost manufacturing; compost is further used by in house horticulture team for green belt development. Below given hazardous waste generated during operations of the individual units are being disposed as per applicable laws. E- Waste & Used Batteries - is being sold to registered recycler. Solid Hazardous Waste - is being disposed through common facility i.e. CHWIF and / or co-processing at cement industries. Used/Waste Oil - It is being sold to authorized

<table>
<tr><th>Sr. No.</th><th>Conditions</th><th>Compliance Status as on 30-09-2017</th></tr>
<tr><td></td><td></td><td>recycler/reprocesser.
Sewage generated at different location is properly collected and sent for treatment in respective treatment plants and after treatment it is being utilized on land for horticulture purpose within APSEZ premises.</td></tr>
<tr><td>v.</td><td>Soil and ground water samples will be tested to ascertain that there is no threat to ground water quality by leaching of heavy metals and other toxic contaminants.</td><td>Complied.
Environment Monitoring is being carried out on regular basis in Port & SEZ area through NABL accredited and MoEF approved agency.

Third party analysis of the ground water is being carried out at every three month by NABL and MoEF&CC accredited agency namely M/s. Pollucon Laboratories Pvt. Ltd. Summary of the same for duration from Apr'17 to Sep'17 is mentioned below.

<table>
<tr><th>Parameter</th><th>Unit</th><th>Min.</th><th>Max.</th></tr>
<tr><td>pH</td><td>-</td><td>7.32</td><td>8.02</td></tr>
<tr><td>Salinity</td><td>mg/L</td><td>0.129</td><td>30.15</td></tr>
<tr><td>Oil & Grease</td><td>mg/L</td><td>1.06</td><td>3.4</td></tr>
<tr><td>Hydrocarbon</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Lead as Pb</td><td>mg/L</td><td>0.013</td><td>0.54</td></tr>
<tr><td>Arsenic as As</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Nickel as Ni</td><td>mg/L</td><td>0.19</td><td>0.19</td></tr>
<tr><td>Total Chromium as Cr</td><td>mg/L</td><td>0.008</td><td>0.021</td></tr>
<tr><td>Cadmium as Cd</td><td>mg/L</td><td>0.007</td><td>0.12</td></tr>
<tr><td>Mercury as Hg</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Zinc as Zn</td><td>mg/L</td><td>0.027</td><td>1.94</td></tr>
<tr><td>Copper as Cu</td><td>mg/L</td><td>0.033</td><td>0.87</td></tr>
<tr><td>Iron as Fe</td><td>mg/L</td><td>0.042</td><td>18.06</td></tr>
<tr><td>Insecticides/Pesticides</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Depth of Water Level from Ground Level</td><td>Meter</td><td>2.4</td><td>3.2</td></tr>
</table>
*BDL = Below Detectable Limit

Soil analysis was carried out by NABL accredited & MoEF&CC approved laboratory M/s. which indicates no threat to ground water quality by leaching of heavy metals and other toxic contaminants. Summary for the same is attached as Annexure – 9.

Please refer Annexure – 9 for detailed analysis reports. Approx. INR 12.0 Lakh is spent for all environmental monitoring activities during this compliance period.</td></tr>
<tr><td>v.</td><td>Construction spoils, including bituminous material and other hazardous materials, must not be allowed to contaminate watercourses and the dump sites for such material must be</td><td>Complied.
Construction spoils including bituminous material is being kept at identified temporary storage area outside CRZ and is being utilized for filling / level raising purpose.
Hazardous material is being stored and is being disposed</td></tr>
</table>

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	secured so that they should not leach into the ground water.	as per Hazardous and Other Wastes (Management and Transboundary Movement) Rules.
vi.	Any hazardous waste generated during construction phase should be disposed off as per applicable rules and norms with necessary approvals of the Gujarat Pollution Control Board.	Complied. Hazardous material is being stored and is being disposed as per Hazardous and other applicable wastes management rules by individual industries under SEZ area. Consent to operate is taken by different industries from GPCB for the said hazardous waste.
vii.	The diesel generator sets to be used during construction phase should be low sulphur diesel type and should conform to Environment (Protection) Rules prescribed for air and noise emission standards.	Complied. DG sets are being used as power back up source in case of power failure. Certificate showing Sulphur content in diesel was submitted along with the compliance submission for the period of Apr'16 to Sep'16. DG sets being used are in conformance to the EPA norms and proof for the same is attached as **Annexure – 10**.
viii.	The diesel required for operating DG sets shall be stored in underground tanks if required; clearance from Chief Controller of Explosives shall be taken.	Complied. Diesel is stored in the underground tank located in existing port area and approval of the same from Chief Controller of Explosives is obtained from PESO with License no. P/WC/GJ/14/4671(P291058) dated 18.12.2015 and is valid till 31.12.2018. Copy of Certificate from CCE was provided in last compliance submission for the period of April'16 to Sep'16 and there is no further change.
ix.	Vehicles hired for bringing construction material to the site should be in good condition and should have a pollution check certificate and should conform to applicable air and noise emission standards and should operated only during non-peak hours.	Complied. Respective industry will have to do necessary construction as per permissions and being SEZ, transportation of material will be as per requirement. The vehicles of on-going construction work enter inside the premises after the fitness check. APSEZ has established a licenced PUC station at SEZ North Gate to monitor the compliance with applicable Motor Vehicle Act for vehicles. Photograph showing the same are attached as **Annexure – 10**. Most of the vehicles bringing construction materials are operated during non-peak hours.
x.	Ambient noise levels should	Complied.

<table>
<tr><th>Sr. No.</th><th>Conditions</th><th>Compliance Status as on 30-09-2017</th></tr>
<tr><td></td><td>conform to residential standards both during day and night. Incremental pollution loads on the ambient air and noise quality should be closely monitored during construction phase. Adequate measures should be made to reduce ambient air and noise level during construction phase, so as to conform to the stipulated standards by CPCB/GPCB.</td><td>Ambient Air Quality (twice in a week) and Noise (once in a month) monitoring are being carried out by NABL accredited and MoEF&CC authorized agency namely M/s. Pollucon Laboratories Pvt. Ltd. Summary of the same for duration from Apr'17 to Sep'17 is mentioned below.
Total Sampling Locations: 5 Nos.
<table>
<tr><th>Parameter</th><th>Unit</th><th>Max</th><th>Min</th><th>Perm. Limit$</th></tr>
<tr><td>PM_{10}</td><td>$\mu g/m^3$</td><td>98.59</td><td>41.58</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>$\mu g/m^3$</td><td>57.41</td><td>16.63</td><td>60</td></tr>
<tr><td>SO_2</td><td>$\mu g/m^3$</td><td>28.97</td><td>5.23</td><td>80</td></tr>
<tr><td>NO_2</td><td>$\mu g/m^3$</td><td>45.57</td><td>15.26</td><td>80</td></tr>
<tr><th>Noise</th><th>Unit</th><th colspan="2">Avg. Value</th><th>Perm. Limit</th></tr>
<tr><td>Day Time</td><td>dB(A)</td><td colspan="2">64.0</td><td>75</td></tr>
<tr><td>Night Time</td><td>dB(A)</td><td colspan="2">60.4</td><td>70</td></tr>
</table>
$ as per NAAQ standards, 2009
Values recorded confirms to the stipulated standards.
Please refer Annexure – 9 for detailed analysis reports. Approx. INR 12.0 Lakh is spent for all environmental monitoring activities during the compliance period of Apr'17 to Sep'17.

Following safeguard measures are taken for abatement of dust and noise emissions.
• Regular sprinkling on road and other open area
• Regular cleaning of roads
• Development of greenbelt along the periphery of the storage yards/back up area
• D.G. Sets having Acoustic enclosures</td></tr>
<tr><td>xi.</td><td>Fly ash should be used as building material in the construction as per the provisions of Fly Ash Notification of September, 1999 and amended as on 27th August, 2003. (The above condition is applicable only if the project site is located within 100 Kms of Thermal Power Stations).</td><td>Complied.

Part of fly ash generated from Adani Power Limited, Mundra is being utilized by Adani Group to manufacture paver blocks and the same paver blocks are used for development of back up area, footpath, colonies area, parking area, approach road etc.

APSEZ has utilized more than 500 MT of fly ash to manufacture paver block during the period of Apr'17 to Sep'17.</td></tr>
</table>

Sr. No.	Conditions	Compliance Status as on 30-09-2017
		Fly ash based PPC cement is used for construction activity.
xii.	Ready mixed concrete must be used in building construction.	Complied. Only RMC is used for construction activity. Mundra Solar Park has utilized RMC for construction activity. Britannia (a new upcoming SEZ industry) is also using RMC for construction activity.
xiii.	Storm water control and its re-use should be regulated as per CGWB and BIS standards for various applications.	Complied. The Central Public Health and Environmental Engineering Organization (CPHEEO) manual is followed CAPEEHO.
xiv.	Water demand during construction should be reduced by use of pre-mixed concrete, curing agents and other referred best practices.	Complied. New Industries are conveyed the message for use of RMC during construction.
xv.	Permission to draw ground water shall be obtained from the competent Authority prior to construction/operation of the project.	Complied. No ground water is used during construction & operation stage of the project. Current sources of water are Narmada water through GWIL and desalination plant of APSEZ. Average water requirement of water is 5.6 MLD out of which 2.8 MLD is obtained from Desalination plant whereas 2.8 MLD is obtained from GWIL.
xvi.	Separation of grey and black water should be done by the use of dual plumbing line for separation of grey and black water.	Point noted and will be complied
xvii.	Fixtures for shower, toilet flushing and drinking should be of low flow either by use of aerators or pressure reducing devices or sensor based control.	Complied. Water flow reducers are provided for taps at various locations of SEZ & Port to reduce the flow by one third. Water Free urinals are installed at Port User Buildings for water conservation.
xviii.	Use of glass may be reduced by up to 40% to reduce the electricity consumption and load on air-conditioning. If	Complied. Industries are conveyed to reduce the use of glass up to 40% to reduce the electricity consumption and load on

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	necessary, use high quality double glass with special reflective coating in windows.	air-conditioning. If necessary, use high quality double glass with special reflective coating in windows. They will comply based on feasibility of implementation.
xix.	Roof should meet prescriptive requirements as per Energy Conservation Building Code by using appropriate thermal insulation material to fulfill requirements.	Complied. Industries are conveyed to meet prescriptive requirements as per Energy Conservation Building Code for roof by using appropriate thermal insulation material to fulfill requirements. They will comply based on feasibility of implementation.
xx.	Opaque wall should meet prescriptive requirement as per Energy Conservation Building Code which is proposed to be mandatory for all air-conditioned spaces while it is aspirational for non-air-conditioned spaces by use of appropriate thermal insulation material to fulfil these requirement.	Complied. Industries are conveyed to meet prescriptive requirement as per Energy Conservation Building Code for opaque wall, which is proposed to be mandatory for all air-conditioned spaces while it is aspirational for non-air-conditioned spaces by use of appropriate thermal insulation material to fulfil these requirement. They will comply based on feasibility of implementation.
xxi.	The approval of the competent authority shall be obtained for structural safety of the buildings due to earthquake, adequacy of firefighting equipments, etc. as per National Building Code including protection measures from lightning etc.	Complied. Industries are conveyed to avail approval of the competent authority for structural safety of the buildings due to earthquake, adequacy of firefighting equipment etc. as per National Building Code including protection measures from lightning etc.
xxii.	Regular supervision of the above and other measures for monitoring should be in place all through the construction phase, so as to avoid disturbance to the surroundings.	Complied.
xxiii.	Under the provisions of Environment (Protection) Act 1986, legal action shall be initiated against the project proponent if it is found that construction of the project has been started without obtaining environmental clearance.	Point noted. Wherever applicable, construction activities have started only after obtaining environmental clearance.

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	Operation Phase	
i.	The PP while issuing the allotment letter to individual member units shall specifically mention the allowable maximum quantity of water usage and effluent generated by each member unit.	Point noted and will be complied. Provisions are made while issuing the allotment letter to individual member units for specifically mentioning the allowable maximum quantity of water usage and effluent generated by each member unit. Sample copy of one of such letter was submitted along with compliance submission for the duration of Oct'16 to Mar'17.
ii.	The PP shall establish an environmental monitoring cell with all the potential polluting units as members to review the environmental monitoring data and suggest improvements.	Complied. APSEZ has a well structured Environment Management Cell, staffed with qualified manpower for reviewing the environmental monitoring data and suggest improvements. Environment Management Cell organogram is attached as **Annexure – 11**. Separate budget for the Environment protection measures is earmarked every year. All environment and horticulture activities are considered at corporate level and budget allocation is done accordingly. No separate bank account is maintained for the same however, all the expenses are recorded in advanced accounting system of the organization. Budget for environmental management measures (including horticulture) for the FY 2017-18 is to the tune of INR 966 lakh. Out of which, Approx. INR 682 lakh are spent during this compliance period. Detailed breakup of the expenditures is attached as **Annexure – 12**.
iii.	Treated effluent emanating from STP shall be recycled / reused to the maximum extent possible. Treatment of 100% grey water by decentralized treatment should be done. Discharge of unused treated effluent shall conform to the norms and standards of the Pollution Control Board. Necessary measures should be made to mitigate the odour problem from STP.	Complied. Sewage generated from individual industry is treated by individual industry itself. Some of the industries are giving their sewage to the CETP for treatment and final disposal. Details of member industries are given in **Annexure – 4**. A common effluent treatment plant of 2.5 MLD capacities is already constructed in SEZ area (having a separate independent environmental clearance) which takes care of effluent generated from member units. The treated effluent from CETP confirms to the GPCB norms. Treated water is used for gardening / horticulture purpose within CETP and SEZ premises. Online monitoring system at the discharge point is

<table>
<tr><th>Sr. No.</th><th>Conditions</th><th>Compliance Status as on 30-09-2017</th></tr>
<tr><td></td><td></td><td>provided to ensure meeting norms as per Environmental Clearance and GPCB norms. Regular supervision is done to ensure there is no odour problem.</td></tr>
<tr><td>iv.</td><td>The solid waste generated should be properly collected and segregated. Wet garbage should be composted and dry/inert solid waste should be disposed off to the approved sites for land filling after recovering recyclable material.</td><td>Complied.

A well-established system for segregation of dry & wet waste is in place, by which all wet waste (Organic waste) is being segregated & utilized for compost manufacturing; compost is further used by in house horticulture team for green belt development. Whereas Dry Recyclable Waste is being sorted out in various categories & finally being sent for recycling.

The following table summarizes the waste management practice (for Apr'17 to Sep'17) for different types of wastes at Mundra:
<table>
<tr><th>Type of Waste</th><th>Quantity</th><th>Method of Disposal</th></tr>
<tr><td>Dry Waste</td><td>115</td><td>After recovery sent for recycling</td></tr>
<tr><td>Food Waste</td><td>98</td><td>Converted to Manure for Horticulture use</td></tr>
</table></td></tr>
<tr><td>v.</td><td>Diesel power generating sets proposed as source of backup power for elevators and common area illumination during operational phase should be of enclosed type and conform to rules made under the Environment (Protection) Act, 1986. The height of stack of DG sets should be equal to the height needed for the combined capacity of all proposed DG sets. Low sulphur diesel should be used. The location of the DG sets may be decided in consultation with the Gujarat Pollution Control Board.</td><td>Complied.

DG sets are used as power back up source only in case of power failure & DG sets are confirming to the Environment Protection Act 1986 and proof for the same is attached as Annexure – 10.

Heights of stacks are maintained as needed for the combined capacity of all attached DG Sets by different member units.

Low sulphur diesel is being used as a fuel within APSEZ and details of the same was submitted to the MoEF & CC along with half yearly compliance report April'16 to Sep'16 and there is no further change.</td></tr>
<tr><td>vi.</td><td>Noise should be controlled to ensure that it does not exceed the prescribed standards, During night time the noise</td><td>Complied.

Noise Monitoring is being carried out on regular basis within SEZ area by NABL and MoEF&CC accredited</td></tr>
</table>

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	levels measured at the boundary of the building shall be restricted to the permissible levels to comply with the prevalent regulations.	agency namely M/s. Pollucon Laboratories Pvt. Ltd. Summary of the same for duration from Apr'17 to Sep'17 is mentioned below. Location of the noise monitoring is nearer to SEZ boundary. 1. Air Strip 2. CETP Please refer Point No. x of Part – B: General Conditions (Construction phase).
vii.	Green belt of adequate width and density preferably with local species along the periphery of the plot shall be raised so as to provide protection against particulates and noise.	Complied. APSEZ has developed its own "Dept. of Horticulture" which is taking measures/ steps for terrestrial greening as well as mangrove plantation. Development of greenbelt at various locations within the SEZ is an ongoing activity. Please refer Point No. xix of Part – A: specific conditions.
viii.	Weep holes in the compound walls shall be provided to ensure natural drainage of rain water in the catchment area during the monsoon period.	Complied. Boundary walls are constructed in such a way by keeping opening for define river path to facilitate free flow of water and it is ensured that water is not stagnant at any given point during rainy season.
ix.	Rain water harvesting for roof run-off and surface run-off, as plan submitted should be implemented.	Complied. Operational units will be encouraged for rainwater harvesting within their premises. However, APSEZ has carried out rainwater harvesting activities in the nearby villages for benefit of the locals. Following measures are taken for the same during the year 2011 – 13 and the same have benefited to the local farmers. 1. Pond deepening activities at villages 2. 18 check dams were constructed under the 'Sardar Patel Sahbhagi Jalsanchay Yojna' Total cost of these efforts was approx. INR 320 lakh. Pond deepening work is completed in Mota Bhadiya and Bhujpur villages. The total cost incurred for this work was INR 16.7 Lakhs during this compliance period.
x.	The ground water level and its quality should be monitored	Complied.

<table>
<tr><th>Sr. No.</th><th>Conditions</th><th>Compliance Status as on 30-09-2017</th></tr>
<tr><td></td><td>regularly in consultation with Central Ground Water Authority.</td><td>To monitor the ground water quality, four bore wells are provided. Third party analysis of the ground water is being carried out quarterly by NABL and MoEF&CC accredited agency namely M/s. Pollucon Laboratories Pvt. Ltd. Summary of the same for duration from April'17 to Sep'17 is mentioned below.
<table>
<tr><th>Parameter</th><th>Unit</th><th>Min.</th><th>Max.</th></tr>
<tr><td>pH</td><td>-</td><td>7.32</td><td>8.02</td></tr>
<tr><td>Salinity</td><td>mg/L</td><td>0.129</td><td>30.15</td></tr>
<tr><td>Oil & Grease</td><td>mg/L</td><td>1.06</td><td>3.4</td></tr>
<tr><td>Hydrocarbon</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Lead as Pb</td><td>mg/L</td><td>0.013</td><td>0.54</td></tr>
<tr><td>Arsenic as As</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Nickel as Ni</td><td>mg/L</td><td>0.19</td><td>0.19</td></tr>
<tr><td>Total Chromium as Cr</td><td>mg/L</td><td>0.008</td><td>0.021</td></tr>
<tr><td>Cadmium as Cd</td><td>mg/L</td><td>0.007</td><td>0.12</td></tr>
<tr><td>Mercury as Hg</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Zinc as Zn</td><td>mg/L</td><td>0.027</td><td>1.94</td></tr>
<tr><td>Copper as Cu</td><td>mg/L</td><td>0.033</td><td>0.87</td></tr>
<tr><td>Iron as Fe</td><td>mg/L</td><td>0.042</td><td>18.06</td></tr>
<tr><td>Insecticides/Pesticides</td><td>mg/L</td><td>BDL*</td><td>BDL*</td></tr>
<tr><td>Depth of Water Level from Ground Level</td><td>Meter</td><td>2.4</td><td>3.2</td></tr>
</table>
*BDL = Below Detectable Limit

Please refer Annexure – 9 for detailed analysis reports. Approx. INR 12.0 Lakh is spent for all environmental monitoring activities during the compliance period of Apr'17 to Sep'17.</td></tr>
<tr><td>xi.</td><td>Traffic congestion near the entry and exit points from the roads adjoining the proposed project site must be avoided. Parking should be fully internalized and no public space should be utilized.</td><td>Complied.
The entry and exit gates of SEZ and port are provided with ample parking area near the gate. The entry / exit complex is fully equipped with traffic control equipments and round the clock security is provided for seamless support. No public space is utilized for parking of the vehicle.</td></tr>
<tr><td>xii.</td><td>A report on the energy conservation measures conforming to energy conservation norms finalized by Bureau of Energy Efficiency should be prepared incorporating details about building materials & technology, R & D Factors etc and submitted to the Ministry along with six monthly monitoring report.</td><td>Point noted and will be complied

Few of the buildings in MSTPL are designed as green building.
Motion sensors are provided at different buildings.

Energy Conservation through Installation of Motion Sensor (Occu switch) & AC Temp. Controls in few of the buildings are provided.

Energy audit of port user buildings are carried out regularly and report of the same is attached as Annexure – 13. Recommendations of this report will be implemented gradually.</td></tr>
</table>

Sr. No.	Conditions	Compliance Status as on 30-09-2017
		Some of the recommendations of these reports are as follows. • EMS should be installed in the plant so that the metering and monitoring of electrical consumption can be improved. • Set point of APFC to be set at unity power factor and it is to be operated in auto mode.
xiii.	Energy conservation measures like installation of CFLs/TFLs for the lighting the areas outside the building should be an integral part of the project design and should be in place before project commissioning. Used CFLs and TFLs should be properly collected and disposed off/sent for recycling as per the prevailing guidelines/rules of the regulatory authority to avoid mercury contamination. Solar panels may be used to the extent possible.	Complied. CFL / LED lighting are being used at various common areas of SEZ. Used CFL are collected and sent for recycling through authorized e-waste collection agency. APSEZ Installed & Commissioned **1.5 MW** roof top solar plant at residential township. Details regarding the same are submitted to the MoEF & CC along with half yearly compliance report for the period from Apr – 2016 to Sep – 2016. APSEZ is also in process to install additional **4.5 MW** roof top solar plant at Agro Storage Godown. Photographs showing the same are attached as **Annexure – 10**.
xiv.	Adequate measures should be taken to prevent odour problems from solid waste processing plant and STP.	Complied APSEZ adopted 5R concept for environmentally sound management of different types of solid & liquid waste. All organic waste is converted to compost for utilization by Horticulture dept. Other solid waste is being segregated and sent for recycling. Proper secondary treatment and disinfection provided to the domestic sewage and treated sewage is being utilized for horticulture purpose. These measures ensure that odor problem is not created in the surrounding area. Please refer Point No. iv of Part – B: General Conditions (Construction phase).
xv.	The buildings should have adequate distance between them to allow movement of	Complied. All the buildings have adequate distance between them

<table>
<tr><th>Sr. No.</th><th>Conditions</th><th>Compliance Status as on 30-09-2017</th></tr>
<tr><td></td><td>fresh air and passage of natural light, air and ventilation.</td><td>to allow movement of fresh air and passage of natural light, air and ventilation.</td></tr>
<tr><td>xvi.</td><td>The environmental safeguards contained in the EIA Report should be implemented in letter and spirit.</td><td>Complied.
Compliance report of environmental management plan and mitigation measures proposed in EIA is attached as Annexure – 8.</td></tr>
<tr><td>xvii.</td><td>Adequate drinking water facility be provided.</td><td>Point noted and being complied.
As a part of dignity of labour adequate provision of drinking water is being provided.
Dedicated drinking water facilities are provides at approx. 200 locations within APSEZ area.
Adequate drinking water facilities have also been provided within office buildings.</td></tr>
<tr><td>xviii.</td><td>Incremental pollution loads on the ambient air quality, noise and water quality should be periodically monitored after commissioning of the project.</td><td>Complied.

Environmental monitoring is being carried out by NABL accredited and MoEF&CC authorized agency namely M/s. Pollucon Laboratories Pvt. Ltd. Summary of the environmental monitoring carried at the time of EIA study (201 and during this compliance period is mentioned below.
<table>
<tr><th rowspan="2">Parameter</th><th rowspan="2">Unit</th><th colspan="2">2011 (As per EIA)</th><th colspan="2">2017</th><th rowspan="2">Perm. Limit$</th></tr>
<tr><th>Max</th><th>Min</th><th>Max</th><th>Min</th></tr>
<tr><td>PM_{10}</td><td>$\mu g/m^3$</td><td>92.20</td><td>48.48</td><td>98.59</td><td>41.58</td><td>100</td></tr>
<tr><td>$PM_{2.5}$</td><td>$\mu g/m^3$</td><td>41.24</td><td>17.57</td><td>57.41</td><td>16.63</td><td>60</td></tr>
<tr><td>SO_2</td><td>$\mu g/m^3$</td><td>18.10</td><td>3.00</td><td>28.97</td><td>5.23</td><td>80</td></tr>
<tr><td>NO_2</td><td>$\mu g/m^3$</td><td>47.66</td><td>22.57</td><td>45.57</td><td>15.26</td><td>80</td></tr>
<tr><th rowspan="2">Noise</th><th rowspan="2">Unit</th><th colspan="2">Avg. Value</th><th rowspan="2">Perm. Limit</th></tr>
<tr><th colspan="2">2010 (As per EIA)</th><th>2017</th></tr>
<tr><td>Day Time</td><td>dB(A)</td><td colspan="2">74.5</td><td>64.0</td><td>75</td></tr>
<tr><td>Night Time</td><td>dB(A)</td><td colspan="2">51.7</td><td>60.4</td><td>70</td></tr>
</table></td></tr>
<tr><td>xix.</td><td>Application of solar energy should be incorporated for illumination of common areas, lighting for gardens and street lighting in addition to provision for solar water heating. A hybrid system or fully solar system for portion of the</td><td>Complied.

Please refer Point No. xiii Part – B: General Conditions (Operation phase).</td></tr>
</table>

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	apartments should be provided.	
xx.	Ozone depleting substance (Regulation & Control) Rules should be followed while designing the air conditioning system of the project.	Complied. Inventorization done by APSEZ for using Ozone friendly gases in ACs. All the HVAC system are with Ozone friendly gases within APSEZ. APSEZL stops procuring new AC's using ozone depleting gases. Out of total domestic AC's 22% AC's already replaced with ozone friendly gases. Remaining AC's will be replaced with ozone friendly gases in phase wise manner. Industries are conveyed to follow Ozone depleting substance (Regulation & Control) Rules while designing the air conditioning system of the project. The same will be implemented by individual unit as per project suitability.
12	Officials from the Regional Office of MOEF, Bhopal who would be monitoring the implementation of environmental safeguards should be given full cooperation, facilities and documents/data by the project proponents during their inspection. A complete set of all the documents submitted to MoEF should be forwarded to the CCF, Regional Office of MOEF, Bhopal.	Complied. Full support is extended to officers of regulatory authorities. Last compliance report for the period of Oct'16 to March'17 was submitted to all concern authorities vide our letter dated 23.05.2017. Copy of the same is also available on our web site. Regional Officer, MoEF&CC, Bhopal visited APSEZ on 21-22 December'16 for monitoring the implementation of environmental safeguards. Full cooperation was extended to them and their team & all requisite documents including the updated compliance report was submitted. Last visit of Regional Office, GPCB was done on 28.08.2017 for Multi Product SEZ. APSEZ has submitted the reply to the site visit report on GPCB-XGN site 12.09.2017. Copy of the letter is enclosed as **Annexure – 14**.
13	In the case of any change(s) in the scope of the project, the project would require a fresh appraisal by this Ministry.	Point noted.
14	The Ministry reserves the right to add additional safeguard	Point noted.

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	measures subsequently, if found necessary, and to take action including revoking of the environment clearance under the provision of the Environmental (Protection) Act, 1986, to ensure effective implementation of the safeguard measures in a time bound and satisfactory manner.	
15	All other statutory clearances such as the approvals for storage of diesel from Chief Controller of Explosives, Fire Department Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponent from the respective competent authorities.	Not Applicable. The approvals of Fire department, Civil Aviation Department, Forest Conservation Act 1980 and Wildlife (Protection) Act 1972 and other applicable approvals will be availed by the project components prior to construction of work if applicable.
16	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act, 1974, the Air (Prevention and control of Pollution) act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification, 2006.	Point noted.
17	The project proponent should advertise in at least two local Newspapers widely circulated in the region, one of which shall be in the vernacular language informing that the project has been accorded Clearance and copies of clearance letters are available with the Gujarat Pollution	Already complied. Not applicable at present. Details regarding the same were submitted to the MoEF & CC along with half yearly compliance report for the period from Apr – 2014 to Sep – 2014. APSEZ has advertised Environmental and CRZ Clearance in two local newspapers "The Indian Express" (in English language) and "Kutch Mitra" (in vernacular language) on 24.07.14 (within 10 days from the date of receipt of the

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	Control Board and may also be seen on the website of the Ministry of Environment and Forests at http://www.envfor.nic.in. The advertisement should be made within 10 days from the date of receipt of the Clearance letter and a copy of the same should be forwarded to the Regional office of this Ministry at Bhopal.	clearance letter) and copy of the same was submitted vide letter dated 13.08.2014 to Ministry of Environment, Forests & Climate Change, Bhopal.
18	Clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.	Point noted.
19	Any appeal against this clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Point noted.
20	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parishad/ Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Already complied. Not applicable at present. Details regarding the same were submitted to the MoEF & CC along with half yearly compliance report for the period from Apr – 2014 to Sep – 2014. Clearance letter is also put up on the website of the Adani ports https://www.adaniports.com/ports-downloads
21	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall	Complied. Last compliance report including results of monitoring data for the period of Oct'16 to Apr'17 was submitted to Regional Office of MoEF, the respective Zonal Office of

Sr. No.	Conditions	Compliance Status as on 30-09-2017
	update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	CPCB and the SPCB. vide our letter dated 23.05.2017. Copy of the same is also available on our web site https://www.adaniports.com/ports-downloads. Last compliance report was also submitted in soft copy through e-mail on 17.07.2017 to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.
22	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	
23	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environmental (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	

adani	Adani Ports and Special Economic Zone Limited, Mundra.	From : April,17 To : September,17
Status of the conditions stipulated in Environment and CRZ Clearance		

ANNEXURE A
Compliance Report of CRZ Recommendation

Note:

With respect to the project components attracting CRZ recommendation from GCZAM, following points shall be noted:

- GCZMA has recommended the CRZ proposal for Sea Water Intake, Outfall system and Pipeline.
- Construction with respect to Desalination Plant, sea water intake and outfall system has not been started yet.
- Existing units are having requisite environmental permissions (from state or central body, as the case may be) for discharging their wastewater, if any, to the Common Effluent Treatment Plant of MPSEZ Utilities Pvt. Ltd. having 2.5 MLD capacity (having a separate individual environmental clearance).
- Treated waste water is being utilized within the premises of CETP and / or SEZ for the gardening / horticulture activities.
- As soon as the need for discharging the effluent / reject form the desalination plant into sea will arise, constriction work for the intake and outfall will be started.

In view of the above mentioned facts, the compliance to the conditions stipulated in the CRZ recommendation will be submitted to all the competent authorities when the construction and operation activities are initiated for the project components attracting CRZ recommendation.

Annexure – B
Compliance Status of MoEF & CC Order dated 18.09.2015

Based on the report submitted by Sunita Narain committee, MoEF&CC issued a Show Cause Notice (SCN) to APSEZ vide their letter dated 30.09.2013. APSEZ replied to the SCN vide letter dated 14.10.2013. Further, an order (containing 10 directions) was issued by MoEF&CC vide their letter dated 18.09.2015. Compliance to these 10 directions is mentioned below.

Sr. No.	Condition	Compliance Status
i	The proposal of extension of the validity of environmental clearance granted to the North Port vide letter dated 12.01.2009 will be considered separately at later stage.	Point Noted and agreed. After receipt of this order, so far APSEZ has not done any application to MoEF&CC for the proposed North port.
ii	Bocha island, ecologically sensitive geomorphological features and areas in the island and creeks around the island will be declared as conservation zone action plan for its conservation must be prepared. M/s. APSEZ should provide necessary financial assistance for this purpose.	Being complied This reply covers direction no ii, iv and v. APSEZ approached National Center for Sustainable Coastal Management (NCSCM), Chennai to carry out the studies as stated in these directions. Upon initiation of the study, a progress report with detailed scope of work and action plan was submitted to all concerned authorities as part of the compliance report for the period Oct'16 to March'17. Further, NCSCM has carried out all necessary site surveys and based on the findings, mathematical modelling using computer software is going on. The 2nd progress report is attached as **Annexure – 2.** Further progress will be submitted upon completion of the study and same will be over by March, 2018. Cost of the study as per the NCSCM proposal is 315.5 Lakh and 90% of the payment against the same is already made as an advance.
iii	The violations of specific condition of all the ECs and CRZ clearances, if any, will be examined and proceeded with the provisions of EP Act, 1986 independently.	Complied The last visit of Regional Officer, MoEF&CC, Bhopal was done on 21st & 22nd December, 2016 for compliance certification. APSEZ provided all requisite information and documents required by the Regional Officer. During the said compliance verification visit, there was no major non-compliance observed. As per the information provided by MoEF&CC, Regional Office, Bhopal they have already submitted the site inspection report to MoEF&CC, New Delhi.

Sr. No.	Condition	Compliance Status
		It may also be noted that GPCB, Regional Office does regular site visit for various components. During the compliance period, two such site visits were carried out. During these visits as well, no major non-compliance observed.
iv	A comprehensive and integrated study and protection of creeks/ mangrove area including buffer zone, mapping of co-ordinates, running length, HTL, CRZ boundary, will be put in place. The plan will take note of all the conditions of approvals granted to all the project proponents in this area e.g. the reported case of disappearance of mangroves near navinal creek. The preservation of entire area to maintain the fragile ecological condition will be a part of the plan in relation to the creeks, mangrove conservation and conservation of bocha island up to baradimata and others.	Being complied Direction no. iv and v being continuous part of the direction no. ii above, the present status is as per our reply against direction no. ii above. The study to be carried out by NCSCM covers preparation of plan for protection of creeks/ mangrove area including buffer zone, mapping of co-ordinates, running length, HTL, CRZ boundary. It will also take note of the preservation of entire area to maintain the fragile ecological condition. The Study is expected to be completed by March, 2018. On completion of the study and acceptance by MoEF&CC, APSEZ will implement the recommendations agreed.
v	NCSCM will prepare the plan in consultation with NIOT, PP and GCZMA. In recognition of the fact that the existing legal provisions under the E(P) Act 1986 do not provide for any authority to impose ERF by the government, the plan will be financed by the PP. the implementation will be carried out by GCZMA. The monitoring of the implementation will be carried by NCSCM.	
vi	There will be no development in the area restricted by the High court of Gujarat. APSEZ shall abide by the outcome of the PIL 12 of 2011 and other relevant cases.	Complied Subject PIL has been disposed off by Hon'ble High Court vide their order dated 17.04.2015 and now there is no restriction on development in the subject area.
vii	APSEZ will submit specific action plan to protect the livelihood of fishermen along with budget.	Complied. Adani Foundation (AF) is the CSR arm of the Adani Group actively working for upliftment of the communities in the surroundings of various project sites of Adani Group. AF has prepared a

Sr. No.	Condition	Compliance Status
		specific action plan to protect livelihood of fishermen at Mundra. Various initiatives taken by Adani Foundation for protection of livelihood of the fisher folk community was submitted during last compliance report Oct'16 to Mar'17. APSEZ is carrying out various initiatives specific to the Fisherfolk community which includes: • Vidya Deep Yojana • Vidya Sahay Yojana – Scholarship Support • Adani Vidya Mandir • Fisherman Approach in SEZ • Machhimar Arogya Yojana • Machhimar Kaushalya Vardhan Yojana • Machhimar Sadhan Sahay Yojana • Machhimar Awas Yojana • Machhimar Shudhh Jal Yojana • Sughad Yojana • Machhimar Akshay kiran Yojana • Machhimar Suraksha Yojana • Machhimar Ajivika Uparjan Yojana • Bandar Svachhata Yojana These initiatives are discussed in detail in the report namely "Silent Transformation of Fisher folk at Mundra". Said report also includes the information related to the planned expenses to the tune of approx. 13.5 Cr. INR for various initiatives for the next five years (2016 – 2021). Copy of the same is already submitted to MoEF&CC vide our letter dated 10.09.2016. Further, APSEZ is actively working with local community (including fishermen community) around the project area and provides required support for their livelihood and other concerns through the CSR arm – Adani Foundation. Brief information about activities in the main five persuasions are mentioned below. Please refer **Annexure – 15** for full details of CSR activities

<table>
<tr><th>Sr. No.</th><th>Condition</th><th>Compliance Status</th></tr>
<tr><td></td><td></td><td>carried out by Adani Foundation in the Mundra region.

<table>
<tr><th>Area</th><th>Activity</th></tr>
<tr><td>Community Health</td><td>• During this six month, total 13077 patients were provided with free Health Care Services by Mobile Dispensaries at 26 villages and 6 Fisher folk settlements. 15993 patients benefitted by the medical services at Rural Clinics at 11 locations.
• During the month, total 4787 transactions were done out of 7487 card holders by beneficiaries Sr. Citizens of 65 Villages Mundra Taluka and they received cash less medical services under this project.</td></tr>
<tr><td>Sustainable Livelihood – Fisher folk</td><td>• Average 130 KL of water was supplied to 983 households from different settlements on a daily basis under Machhimar Shudhh Jal Yojana.
• Computer Training: 30 Fisherman Youth
• Sewing Training: 60 Women
• Mangrove Plantation: 4000 Man-days
• Painting Labour: 3800 Man-days</td></tr>
<tr><td>Education</td><td>• Praveshotsav Kit is ready for 106 schools of Mundra Taluka, 6 Schools of Mandvi Taluka and 8 Schools of Anjar Taluka. Total 2200 kit distributed.
• Education Material support to 67 Students of Juna Bandar, Zarpara, Navinal, Bhadreshwar & Vandi of Standard 9th and 10th.</td></tr>
<tr><td>Rural Infrastructure</td><td>Work Completed
• Mota Bhadiya and Bhujpur- Pond deepening work
• Bhadreshwar- Prayer shed in School
• Kandagara – Garden work in matang temple
• Zarapara – Canal repairing work
• Shekhadia- Pagadiya fisherman road repair
• Shekhadia- construction of Bhunga Pagadiya fisherman
• Kutdi bander- construction of cricket pitch
• ASDC- civil works completed.
• Kandagara - Repairing of Checkdam and river widening
• Mundra- crematorium development
• Ragha - Prayer shed in primary school</td></tr>
</table>
</td></tr>
</table>

Sr. No.	Condition	Compliance Status
		<table><tr><td></td><td>• Shekhadiya – Const. of house of fisherman</td></tr><tr><td>Skill Development</td><td>• Soft skill training – 206 Nos. • Technical Training – 400 Nos.</td></tr></table> Budget for CSR Activity for the FY 2017-18 is to the tune of INR 1187 lakh. Out of which, Approx. INR 427 lakh are spent during this compliance period.
viii	APSEZ will voluntarily return the grazing land, if any, in their possession.	Point noted. All lands are acquired through proper procedure prescribed by State Government. However APSEZ has voluntarily given 400 acres of land back to Zarpara village for the purpose of Gauchar.
ix	A regional strategic impact assessment report with a special focus on Mundra region will also be prepared. The cost towards these studies will also be borne by PP.	Being complied This reply covers direction no ix and x. Based on the ToR finalized by GCZMA (as per the instructions of MoEF&CC) for carrying out regional impact assessment study, APSEZ awarded the work to NABET accredited consultant M/s. Cholamandalam MS Risk Services Ltd. to carry out the studies as stated in these directions. Upon initiation of the study, a progress report with detailed baseline information and action plan was submitted to all concerned authorities as part of the compliance report for the period Oct'16 to Mar'17. Further, CMSRSL has finalized the objectives, methodology and data inputs for carrying out modelling of the impact assessment (through dedicated mathematical modelling tools) of various environmental attributes. Following modelling exercises are being carried out. • Ambient air quality • Marine (Hydrodynamic, Thermal & Salinity dispersion, Sediment transport) • Noise • Traffic • Oil spill • Water resource and salinity ingress • Land Use / Land Cover

Sr. No.	Condition	Compliance Status
		• Socioeconomic, Regional infrastructure • Waste management • Ecology, Bio diversity and Fisheries • Shoreline change Preparation of these reports require extensive use of modelling software and study of the available information / research reports to assess the impacts on individual attribute of environment. Upon completion of the modelling reports and based on the findings of the study, an Environmental Management Plan (regional level) will be prepared. Further progress will be submitted upon completion of the study. Total cost of the study is approx. INR 1.3 cr. which is financed by APSEZ.
x	In the subject matter of thermal power plant, the proposed regional strategic impact assessment analysis will take in to account salinity aspect along with its potential environmental impact to suggest future corrective actions as well as the guiding tool on extension and additional of the capacities.	Being complied. The study mentioned at Sr. No. ix above covers the necessary study on salinity aspect along with its potential environmental impact.

Annexure – 1

Creek System (before & after)

As per Marine EIA of Waterfront Development project, prominent creek system in the study region are

1. Kotdi
2. Baradimata
3. Navinal
4. Bocha
5. Mundra (Oldest port (Juna Bandar) leading to bhukhi river)

All above creeks are in existence and well functioning as on date.

Culverts & Bridge

APSEZL has so far constructed 19 culverts having total length of approx. 1100 m and total cost of Rs. 20 Crores.

Culverts & Bridge






Three RCC Bridges have been constructed over Kotdi creek with total length of 230 m and cost of Rs. 10 Crores.

adani

Kotdi Creek

Outfall of APSEZL

Outfall of APSEZ and free flowing Kotdi Creek

Annexure – 2

NCSCM
NATIONAL CENTRE FOR SUSTAINABLE COASTAL MANAGEMENT
Ministry of Environment, Forest & Climate Change, Government of India

Prof. Dr. R. Ramesh
PhD (JNU) PhD (McGill)
Director

No. NCSCM/APSEZ/1/2017 Date: 21st November 2017

Dear Shri Shalin Shah

Kindly refer to the Service order No PURC/F/012 dt 29.8.2017 awarding consultancy to NCSCM on Preparation of comprehensive and integrated conservation plan for the APSEZ area including detailed bathymetry study and protection of creeks/mangrove area including buffer zone, mapping of co-ordinates, running length, HTL and CRZ boundary.

A progress report indicating status under the above consultancy project up to October, 2017 is enclosed. We have already sent you the hard copies of bathymetry charts of creeks. Kindly acknowledge the receipt of this report.

Best regards,

R. Ramesh 21/11/2017

R. Ramesh

Encl: as above

To
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Progress report on APSEZ consultancy on Integrated Management plan for mangroves and creeks in and around the APSEZ Mundra

1. Background

The Ministry of Environment and Forests have accorded Environmental Clearance (EC) vide Letter No. F.No.10-138/2008-IA.III dt. 15th July, 2014 to M/s Adani Ports and Special Economic Zone Ltd (APSEZ) to set up a multi-product SEZ at Mundra, Kachchh, Gujarat (Fig.1). The project involves development of SEZ in a notified SEZ area of 6641.2784 ha for which Environmental and CRZ clearance has been given. The activities proposed in the SEZ include:

- Processing zones
- Non-processing zones
- Warehousing zones
- Road network (trunk as well as internal)
- Bridges or culverts over natural drains
- Rail and IT communication networks
- Effluent collection network
- Water supply through freshwater sources and desalination
- Conservation & drainage network
- Effluent collection network
- Social infrastructure
- Existing airstrip
- Municipal solid waste disposal site
- Utilities & supporting infrastructure
- Disposal of treated sewage, effluents and brine from desalination plant

The SEZ covers both inland and water front areas. Industrial plots will be made by APSEZ and shall be given to the firms that would be setting up individual industries of any type who need to obtain EC before initiating their projects. The industries envisage to utilize the services of Adani port for transport of imported and exported goods. While according EC to the project, the MoEFCC have stipulated General and Specific conditions in its letter F.No.10-138/2008-IA.III dt 15 July 2014 in (viii) and (ix) of para 11 A (Specific conditions). The details of the ones relevant to NCSCM are:

- The Project Proponent (PP) shall get detailed bathymetry done for all the creeks and rivers within Port and SEZ areas along with mapping of co-ordinates, running length, HTL, CRZ boundary, mangrove area including buffer zone through NCSCM/NIOT.

- PP shall also get prepared a detailed action plan for conservation and protection of creeks, mangrove area etc. through NCSCM/NIOT and submit the same to GCZMA for their examination and recommendation. GCZMA will submit its recommendations to MoEFCC for approval.

Further in its order F.No.10-47/2008-IA.III dt 18 Sept. 2015, it gave following directions relevant to NCSCM:

A Comprehensive and integrated conservation plan including detailed bathymetry study and protection of creeks/mangrove area including buffer zone, mapping of co-ordinates, running length, HTL, CRZ boundary will be put in place. The plan will take note of all the conditions of approvals granted to all project proponents in this area, e.g., the reported case of disappearance of mangroves near Navinal creek. The preservation of entire area to maintain fragile ecological condition will be a part of the plan in relation to the creeks, mangrove conservation and conservation of Bocha island up to Baradimata and others.

NCSCM will prepare the plan in consultation with NIOT, PP and GCZMA. In recognition of the fact that the existing legal provisions under the E(P) Act 1986 do not provide for any authority to impose ERF by the Government, the plan will be financed by the PP. The implementation will be carried out by GCZMA. The monitoring of the implementation will be carried by NCSCM.

2. Compliance to the EC conditions

Accordingly Adani Ports and Special Economic Zone Limited (APSEZ) has requested the National Centre for Sustainable Coastal Management (NCSCM) to conduct bathymetry survey in creeks that are present in and around APSEZ area and for preparation of an integrated conservation plan for mangroves and creeks. Terms of Reference (ToR) were prepared and agreed upon with the following major components

a. Detailed bathymetry of creeks including the ones distributed on the seawater side, along with mapping of co-ordinates, running length, HTL, CRZ boundary in and around APSEZ area

b. Mapping of mangroves distributed in and around APSEZ area including their seaward side with buffer zones and
c. Preparation of Comprehensive and Integrated plan for preservation and conservation of mangroves and associated creeks

3. Description of Methodology

Bathymetry survey involves measurement of depth of creeks and major branch channels originating from the creeks. The method used to measure the depth is based on echosounder for depth > 0.5 m and tide pole for locations < 0.5 m. A dual beam echosounder was used to measure the depth in deeper areas and a graduated tide pole is used in shallow areas (<0.5 m of depth). Bathymetry measurements were made during high tide and tide corrections were made to account for tide induced water depth. For this purpose, tide gauges calibrated tide poles were placed at regular intervals to obtain water levels during different time period of bathymetry measurement. The data collected was processed in HYPACK software which has programmes for tide correction of bathymetry data. In dry channel branches of main creeks, Real Time Kinematic GPS is used to determine bottom levels with respect to adjoining ground to estimate depth. All the bathymetry data collected are presented in a chart with reference to Chart Datum.

4. Progress made so far:

4.1. Bathymetry of creeks

The area in and around APSEZ has five major creeks namely (i) Kotdi creek originating from Daneshwari River with two branches, (ii) Baradimatha creek originating from Nagavati river with two branches, (iii) Navinal creek adjoining main Adani Port (iv) Bocha creek and (v) Khari creek originating from Phot and Bhuki rivers. The bathymetry survey of above-mentioned 5 creeks (with branches) was initiated in April 2017 in association with M/s Indomer Coastal Hydraulics, Chennai which is specialized in bathymetry measurements. The measurements were carried out using Ceeducer PRO Echosounder/ Garmin Echosounder supported by Trimble DSM 232 DGPS Beacon Receiver (to co-record position for every depth measurement), HYPACK MAX Data collection and processing software.

The survey was carried out using low draft survey vessel equipped with safety gears. The echosounder transducer was mounted by positioning below the water surface. The DGPS receiver antenna was mounted on the mast vertically in line with the transducer, so that it represents the exact coordinates of the location where the depth is simultaneously measured by the transducer. The necessary inputs were given in HYPACK data collection software before the commencement of the survey.

The planned track lines were displayed on the monitor at the wheel for navigation. Watch guards were positioned at bow, transducer/antenna and heave compensator at rear end. The data was continuously collected in the onboard PC along each transect. After each day of data collection, the entire data was downloaded to external hard disc and stored. The recorded data will include: date, time, latitude, longitude, X coordinate, Y coordinate and heave. The depth data was recorded at 0.2 sec interval.

Bathymetry measurements have been completed in all the 5 creeks and the surveyed areas are indicated in Fig.1. In smaller channels with depths <0.5 m and adjoining mud flats, collection of topographic data has been completed. The entire data collected has been processed using HYPACK software with corrections on tidal variation and transducer draught and the depth values will be presented in maps with contour intervals.

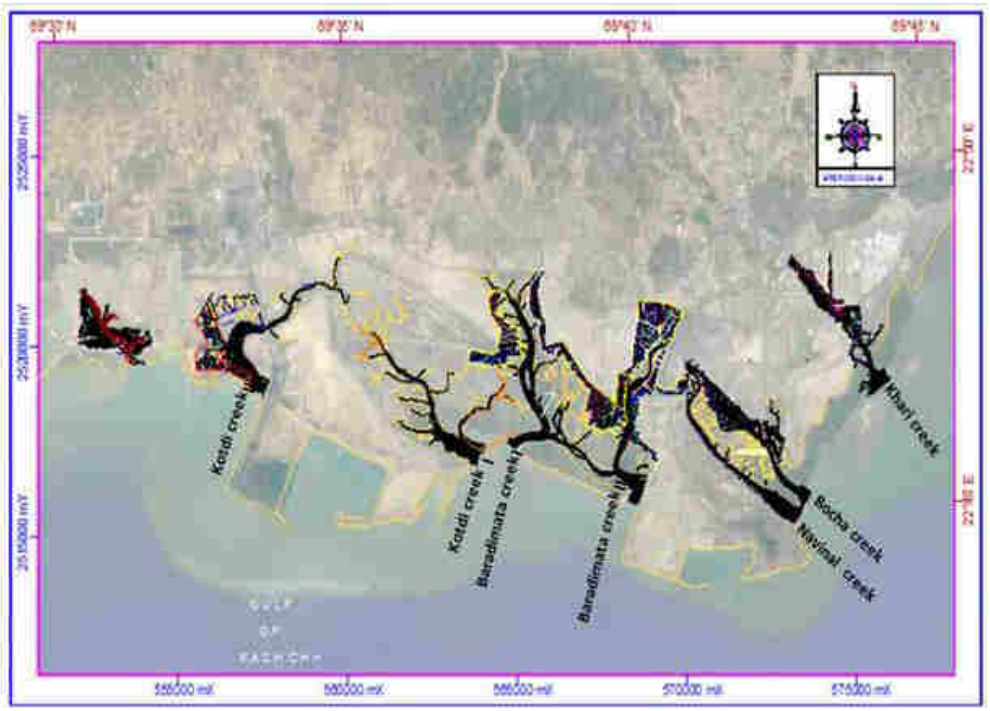


Fig.1: Bathymetry Survey – Completed areas indicated in black colour

The bathymetry charts of the creeks are placed in Figs. 2-6. The depth values are indicated with reference to Chart datum (which is presumably Lowest low tide level) and the depth may increase during high tide conditions, depending on the tidal range prevalent at a location Table 1. The green colours in the chart are inter-tidal areas with respect to mean highest high water spring. Areas beyond inter-tidal areas (elevated areas) have been indicated in yellow colour.

NCSCM in association with its consultant M/s Indomer Coastal Hydradulics, Chennai has completed the bathymetry of creeks in and around APSEZ area. The highlight of bathymetry of the creeks and running length of the creeks with water parts are indicated in Table 1.

Table 1. Depth ranges and running length of creeks in and around APSEZ area

Name of the creek	Depth range (m) w.r.t CD*	Running Length of water part of the creek during High Tide (Km)*	Running Length of the Creek (Km) including water and dry parts of the creek*
Kotdi creek I	0.1-1m	5.00	5.00
Kotdi creek II	0.1-1.8m	7.57	8.38
Baradimata creek I	0.1-5.0 m	6.15	6.29
Inter-connecting channel	Inter-tidal	2.25	2.25
Baradimata creek II	0.1-5.6m	5.59	5.94
Navinal Creek	0.1-16.8m	4.69	4.80
Bocha creek	0.1-12.2m	3.95	4.42
Khari Creek	0.9-8.9 m	3.80	4.22

* Source: Bathymetry charts at Figs 2-6.

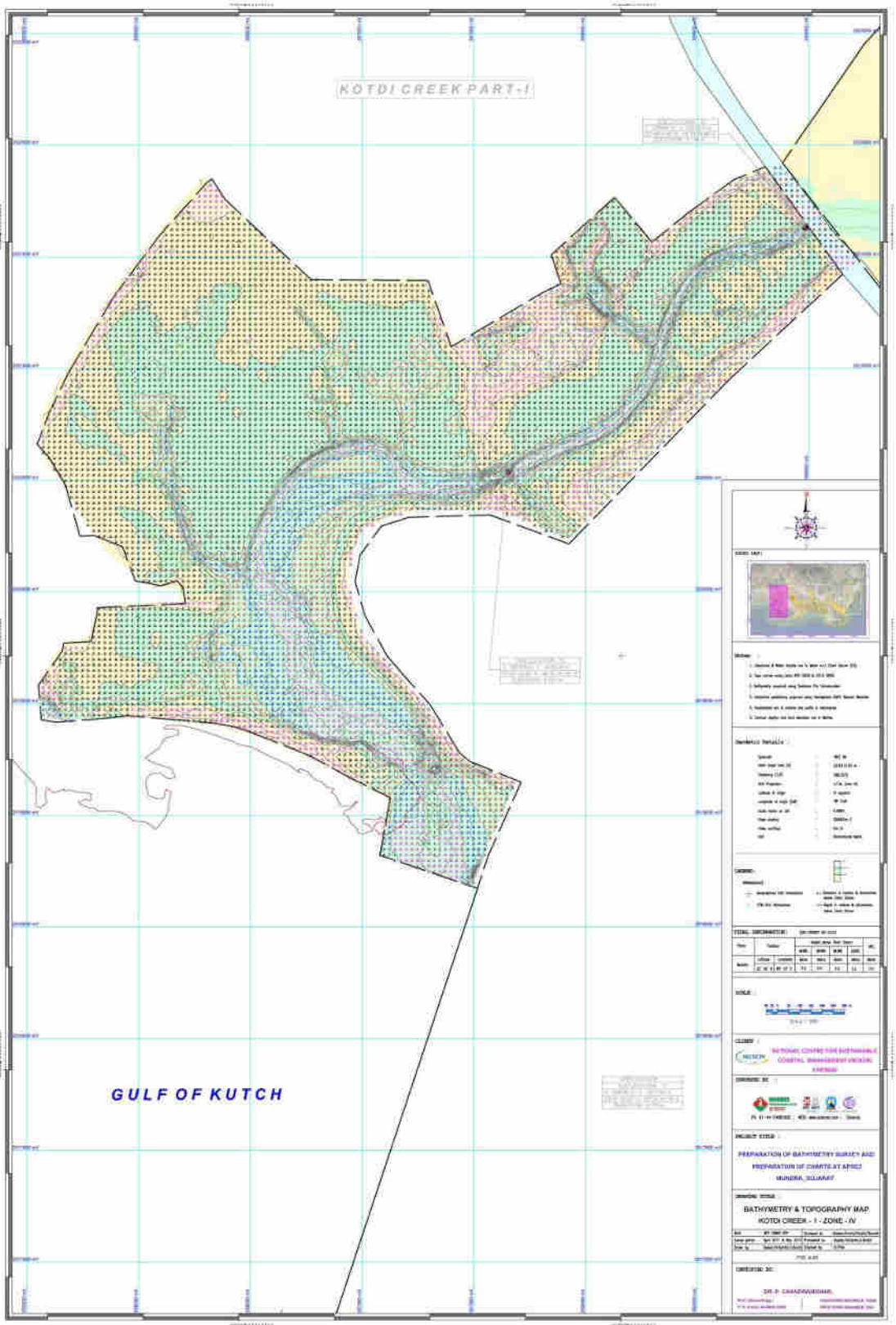


Fig 2 Bathymetry of Kotdi creek I and elevation (numbers with underscore mark) in adjoining mangrove areas

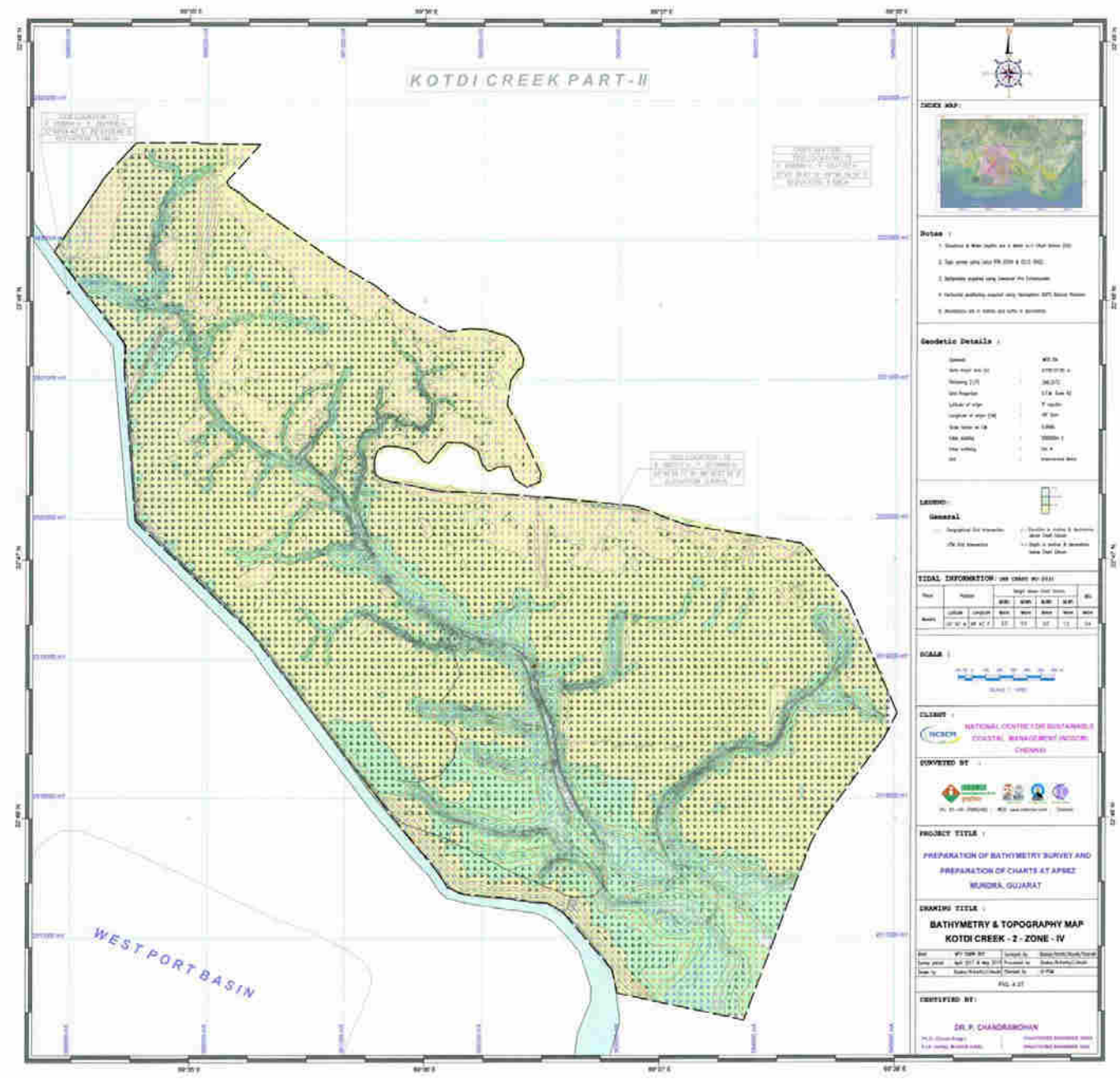


Fig 3 Bathymetry of Kotdi creek II and elevation (numbers with underscore mark) in adjoining mangrove areas

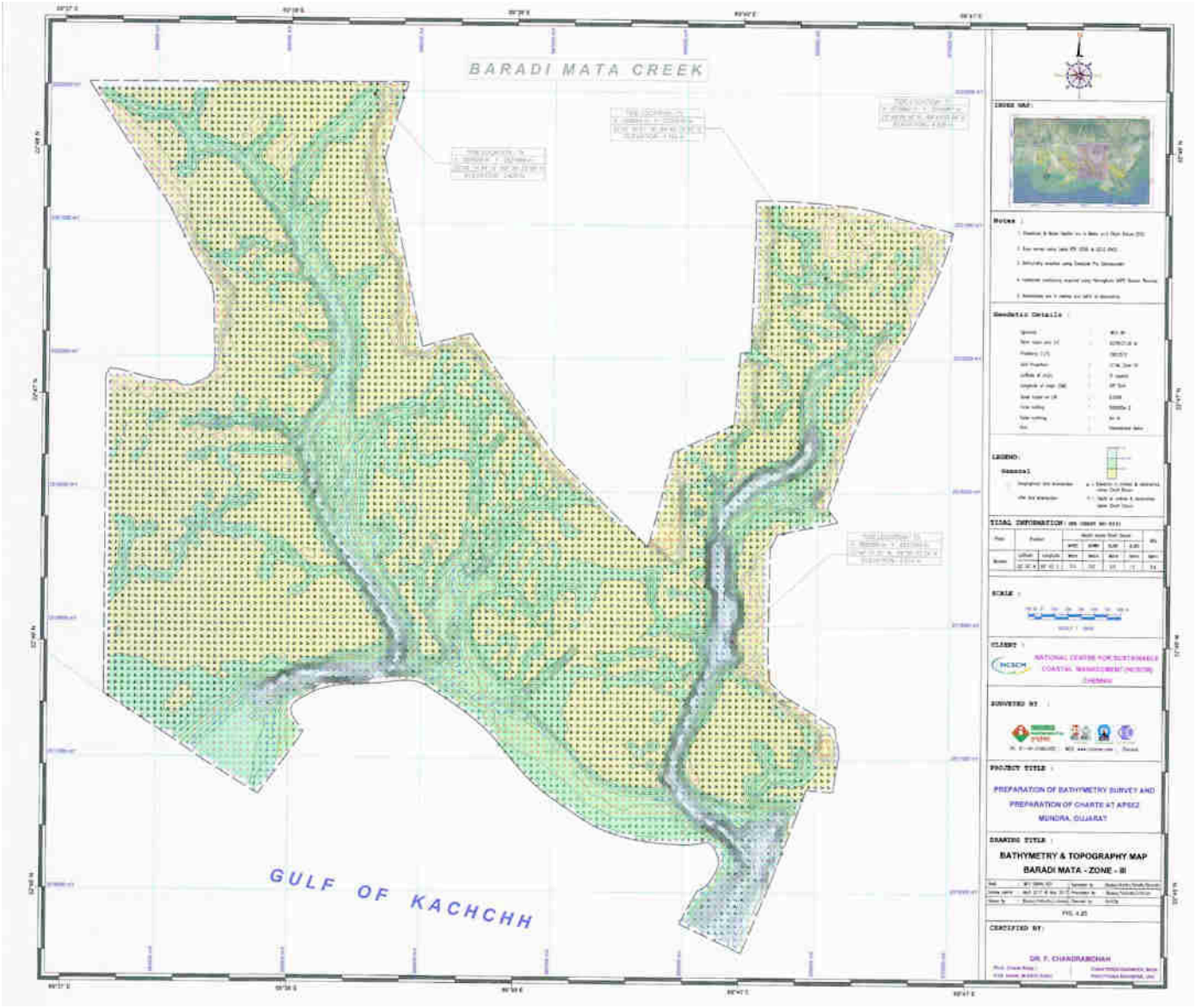


Fig.4. Bathymetry of Baradimata creeks and elevation (numbers with underscore mark) in adjoining mangrove areas

Kotdi and Baradimata creeks: These creeks are shallow compared to Bocha, Navinal and Khari creeks. While Kotdi creeks exhibited least depths and mostly exposed during the low tide conditions, the mouth regions of Baradimata creek was fairly deeper compared to Kotdi creeks. (Figs.2-4)

Navinal: Navinal creek study indicates that at the mouth and port areas were deeper with depths ranging from 0.1-16.8 m. The depth decreases from 16.8m at the mouth to 0.1m beyond the port limit. The depth was shallow, as low as 0.13 m towards interior parts of the creek. most of the branches of main creek, the creeks were totally exposed during the low tide. (Fig.5)

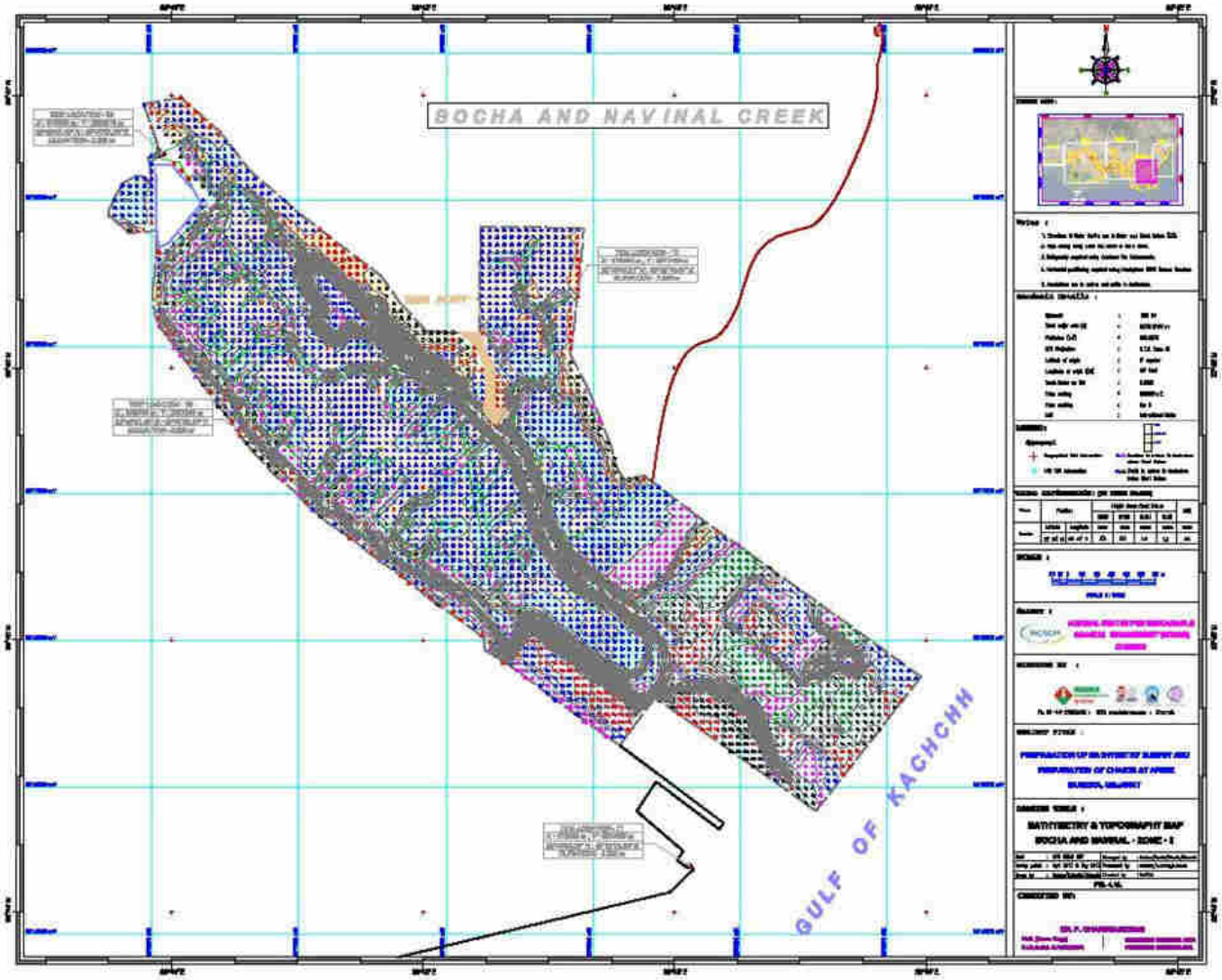


Fig.5 Bathymetry of Navinal and Bocha creeks and elevation (numbers with underscore mark) in Bocha Island

- **Bocha**: The water depth ranged from 0.3 to 12.2 m. (Fig.5) and increased from mouth to reach 12.2 m at middle of the creek. There after the depth became shallow and the creek and its branches were exposed during the low tide

- **Khari (Juna Bandar creek):** The shallow water depth of Khari creek at Junabandar with the depths ranging from 0.9 to 8.9 m and the deeper depths were noticed close to mouth areas (Fig.6)

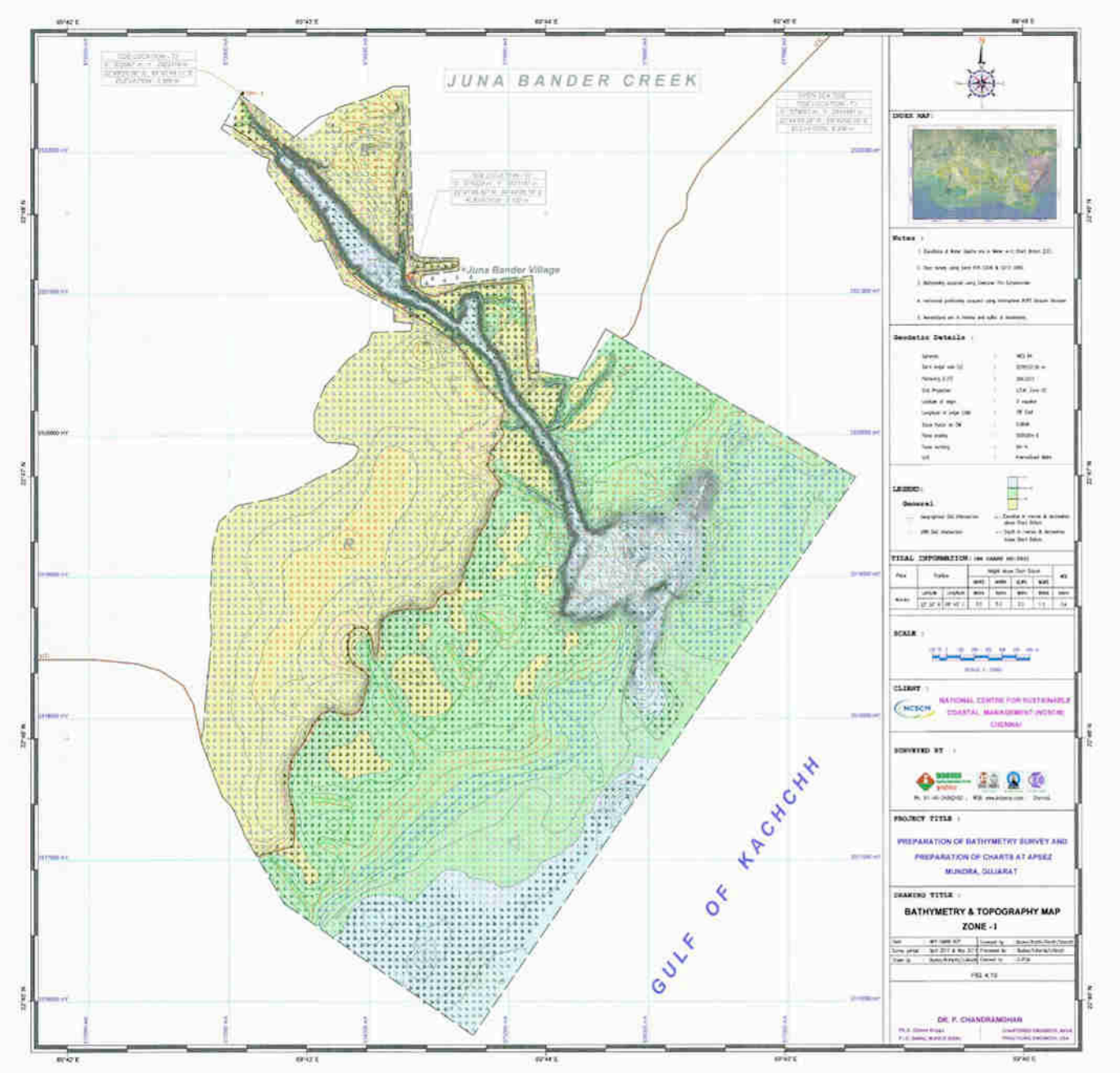


Fig.6. Bathymetry of Khari (Juna bundar) creek and elevation (numbers with underscore mark) of mangrove and mud flats around the creek

4.2. . Mapping and status of Mangroves

Maps of mangrove areas in and around APSEZ, namely Bocha island, along creeks of Bocha and Navinal, Baradimata creeks and Kotdi creeks using Google Earth pro image of 2016 for Mundra area have been prepared and field rectified. The field survey was conducted along the creeks in and around APSEZ area namely, Bocha (including island), Navinal, Kotdi, Baradimata (land mass also) and Khari between 9th and 14th of May, 2017, using Line Transect (LT) method (100m; triplicate; 50m interval). Quantitative data on mangrove vegetative structures were collected by laying quadrats (10 × 10 m) along the line transects. In each line transect, three quadrats were laid at 0, 50 and 100 m points. Within each plot, all mangroves were identified up to species level and counted according to maturity categories, such as seedling (≤1m) and tree (>1 m). Vegetation measurements such as, tree height (measured by a Distometer (Leica Disto D510)) and diameter at breast height (using a measuring tape) were made and the number of seedlings and saplings were counted species-wise in each quadrat. Further, the associated flora and fauna in each creek were identified and documented. While categorizing mangroves in terms of their density, they have been classified as dense, sparse (low height or shrubs with distance between patches less than 5 m) and scattered (shrubs and distance between patches is more than 5 m). Though the terminology of scattered is not used in mangrove literature, in order to explicitly indicate the mangrove patches are distributed far apart, this terminology has been used.

The status of the mangroves along the creeks and adjoining land/island are given in Table 2. Descriptions related to mangroves of creeks have been given in subsequent sections below.

Table 2. Summary of the structural characteristics of mangroves distributed along the study sites of APSEZ

Site Name	Area of dense mangroves (ha)*	Species Richness (*D*)	Density (No/Ha)	Basal Area (m^2/H)	Complexity Index	Diversity Indices		Recruitment (No/Ha)	Mean Girth (m ±SD)	Mean Height (m ± SD)
						H′	*S*			
Bocha island	332(571)	3	2700	39.48	22.7	0.48	0.71	5500	0.35 ± 0.24	1.97 ± 0.009
East side of Navinal Creek	Included in Bocha island	3	1566	56.58	60.74	0.17	0.93	16633	0.62 ± 0.25	2.96 ± 0.007
Khari Creek	190 (288)	2	1266	18.92	11.11	0	1	8500	0.43 ± 0.13	4.54 ± 0.002
Baradimata Creek	216 (1036)	3	1933	19	18.16	0.66	0.53	12500	0.32 ± 0.13	4.21 ± 0.018
Kotdi Creek	17 (370)	3	1733	22.72	21.90	0	1	13000	0.4 ± 0.03	5.37 ± 0.005

- Value refers only to dense part of the mangroves
- Basal area refers to cross-sectional area of a tree stem measured at breast height (1.4m)
- Complexity index of tree
- Girth indicates circumference or diameter of trunk of a tree

* values in parenthesis indicate total mangrove cover

4.2.1. Kotdi creek

Kotdi creek is located close to the West port area and adjacent to the Baradimata creek. This creek has many sub-creeks and it surrounds the West port, opening to the Arabian Sea on east and west sides of the port.

Distribution of mangroves along the creek and nearby land areas are indicated in Fig.7. It may be seen that the total mangrove cover was about 370 ha out of which dense mangroves occurred to the extent of only 17 ha, followed by sparse mangroves distributed in 181 ha. The scattered mangrove had coverage of 172 ha.

Fig.7. Mangroves of Kotdi – I and Kotdi – II creeks

a. Mangrove species composition

The mangrove species distributed in this creek includes *Avicennia marina*, *Ceriops tagal* and *Rhizophora mucronata*. The western side (northeast of West port) of the creek has dense and tall mangroves from the mouth towards the inside of creek upto≈1 km where *A. marina* dominates followed by a few *R. mucronata*. The mangroves are sparse and stunted, and beyond the *A. marina* zones, natural colonization of *C. tagal* was noticed. The eastern side of the creek is characterized by sparse, stunted, single stretched (2 m width) *A. marina* zonation followed by dense *Prosopis* sp. and sparse salt marsh towards the landward side. Plantation of *A. marina* by Gujarat Forest Department was witnessed here. In the middle of the creek (Opposite to Adani Power plant), dense and stunted (>1 m height) *A. marina* was observed; however, from this point up to the mouth (north side of the West port, where it mixes with Arabian Sea) mangroves are sparse and stunted (Fig. 8a & 8b).

Fig. 8 a Google image (2016) indicating location of sparse/stunted mangroves in Kotdi I creek (indicated as 36 - Lat.22^0 46′ 33″ Long 69^0 36′ 33″)

Fig. 8b. Photo of Stunted growth of mangrove in Kotdi I creek (Lat.22^0 46′ 33″ Long 69^0 36′ 33″)

Analysis with image of the 2004 at this location indicates that the sparse and scattered mangroves were earlier habited by mangrove vegetation of different density.

c. Associated flora and fauna

Dense distribution of *Arthrocnemum indicum* was found beyond the mangroves on the western side of the creek whereas, the eastern side has sparse vegetation. Mangrove crabs namely *Uca annulipes*, *Uca tetragonum* and *Metapograpsus messor* were observed here. Birds were represented by *Myceterialeuco cephala*, *Ardea purpurea*, *A. cinerea* and *Egretta gularis*.

d. Mangrove structure

The overall density of mangrove trees was found to be 1,733 individuals ha^{-1}. The basal area and complexity index estimated were 22.72 m^2 ha^{-1} and 21.90 respectively (Table 2). The diversity indices were found to be low (H' = 0, D = 1). In the case of recruitment of mangroves, 13,000 individuals ha^{-1}were recorded. The mean girth and height of mangrove trees were 0.4 ± 0.03 and 5.37 ± 0.01 respectively.

e. Issues

The major issue to the mangroves of both parts of the Kotdi creek include, higher elevation in scattered mangrove area to the extent of 0.1 to 2.4 m from High water level of that location (~5.5m), which prevents penetration of tidal water that is required for propagation of mangroves (Fig.2)

f. Mitigation measures

Hydrological correction is required for enhancing the frequency of tidal inundation to the sparse and scattered mangrove areas so that natural colonization can take place. This will be attempted in the Conservation plan of mangroves based on modeling studies which will provide extent of possibilities for increasing tidal flow in to the Kotdi creeks.

4.2.2. Baradimata creek

The Baradimata creek is located between the South port and West port and adjacent to the Kotdi creek (Fig.1). This creek is divided into two major creeks and many sub-creeks. Presence of distinct islets are witnessed inside the creek. Major creeks open into the Arabian Sea on the northern side and are interconnected close to the mouth.

Fig. 9. Mangroves of Baradimata – I and Baradimata – II creeks

a. Mangrove species composition

Mangrove cover of the Baradimata land area was about 1036 ha (Fig.9). Out of this, scattered vegetation was found to be dominating with 45.5% (471 ha), followed by sparse vegetation with 33.7% (349 ha) and the least being dense vegetation with 20.8%.

(216 ha). The species present were *Avicennia marina*, *Ceriops tagal* and *Rhizophora mucronata*. Mangroves along the creek banks (periphery) were dense (≈10 m width) beyond which scanty distribution of salt marsh could be seen. The major creek on the eastern side has all the three species with a good dense patch of *R. mucronata* between the *A. marina*. In the case of the second major creek, the western side had a mono specific distribution of *A. marina* with stunted growth, whereas tall (≈6.5 m) and dense mangroves were distributed on the east side of the creek. The natural colonization of *A. marina* was witnessed along the northern side of the pit near to the mouth and the creeks were connected together. The island found on the seaward side has dense mangroves on the northern side and sparse mangroves on the southern side.

c. Associated flora and fauna

Sparse distribution of *Arthrocnemum indicum* was recorded behind the mangrove area towards landward side. Dense colonization by *Prosopis* sp. was observed just behind the mangrove zonation. Mangrove crabs, *Uca annulipes*, *Uca* sp. and *Metapograpsus messor* and swimming crab *Portunus pelagicus* were recorded here. Coastal birds namely *Casmerodius albus*, *Myceterialeuco cephala*, *Ardea purpurea*, *Egretta gularis*, *Platalealeu corodia* were observed in this creek.

d. Mangrove structure

The density of mangrove trees in the Baradimata creek is 1,933 individuals per hectare (Table 2). The basal cover of mangrove trees was recorded to be 19 m^2 ha^{-1}. The estimated complexity index was 18.16 (Table 2). The diversity indices were found to be low (H'= 0.66, D = 0.53). The recruitment of juveniles recorded was 12,500 individuals ha^{-1}. The mean girth and height is calculated to be 0.32 ± 0.13 and 4.21 ± 0.02 respectively.

e. Observation and recommendation

The sparse and scattered mangrove areas have been remaining in the similar conditions over the years as evidenced when Satellite images of 2016 and pre 2005 were compared. Hence it is suggested that the area should remain as per present condition without undertaking any developmental activities. No dredge spoil should be dumped off the mouth which may affect the tidal flow and also may cause erosion of banks of creeks resulting in loss of mangrove vegetation.

4.2.3. Bocha island and creek

The Bocha island is situated between Navinal and Bocha creeks. Mouth of the Navinal creek is used as Port basin. The total mangrove cover of the island is about 571 ha including banks of Navinal and Bocha creeks (Fig.10) with dense mangroves contributing to the highest percentage of 58% (332 ha), followed by scattered as 24 % (135 ha) and sparse 18% (104 ha).

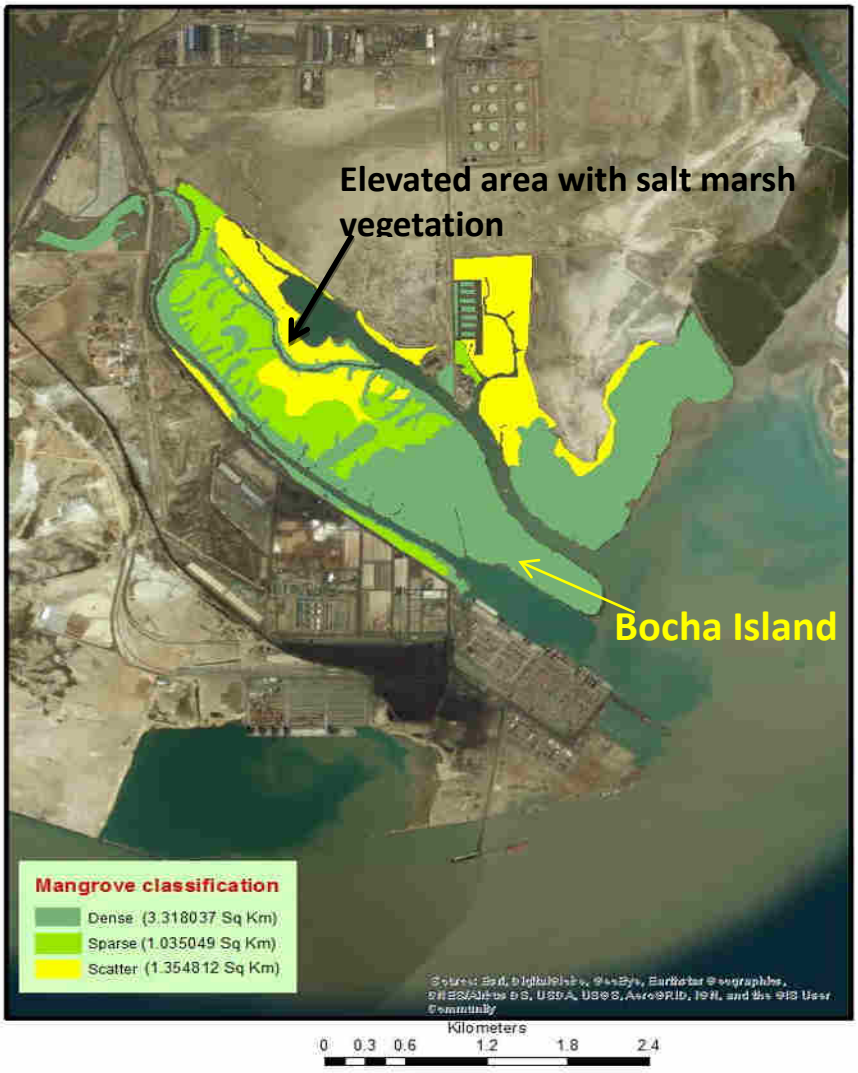
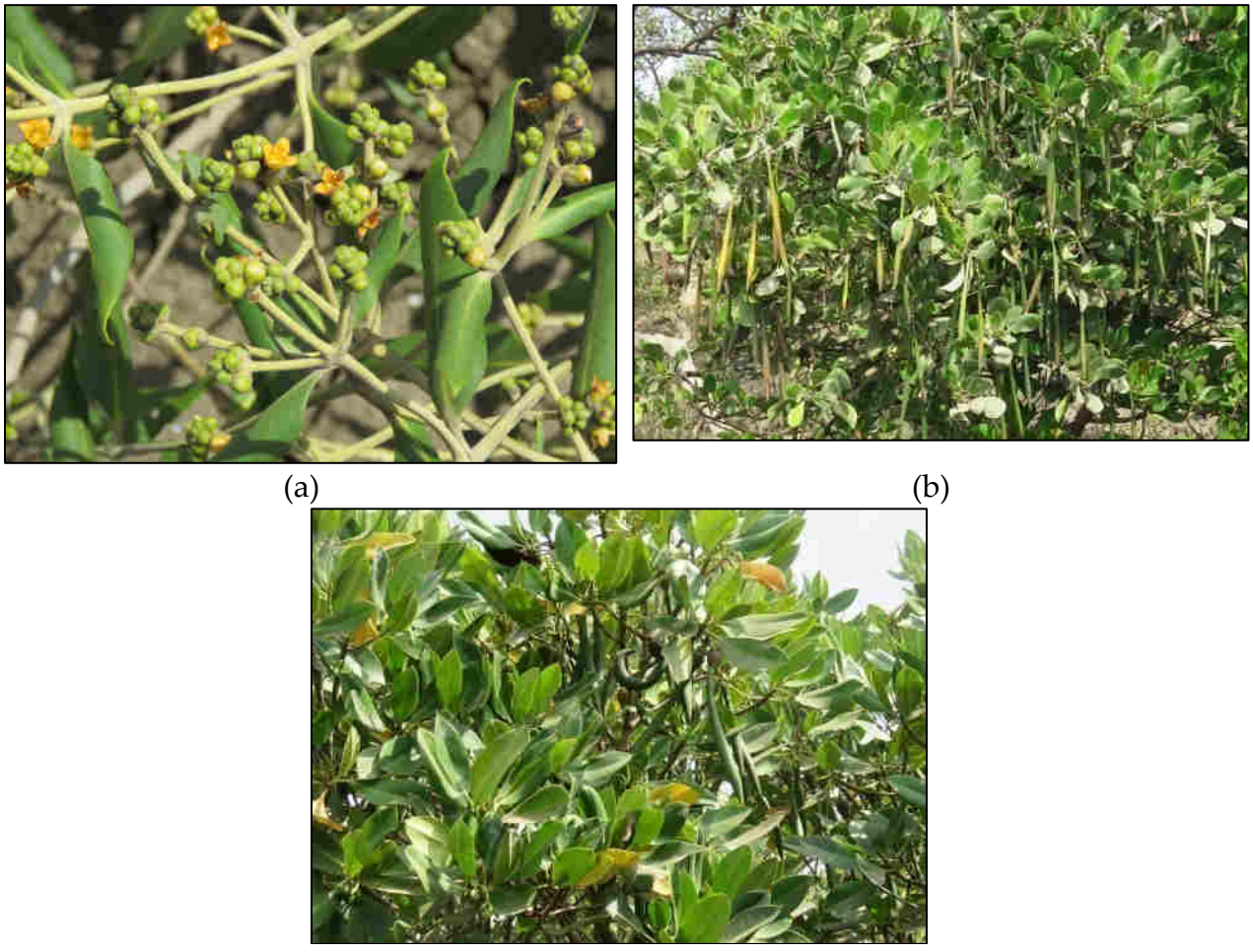


Fig. 10. Distribution of mangrove vegetation in Bocha island

a. Mangrove species composition

There were three mangrove species distributed along the Bocha creek *viz*., *Avicennia marina, Ceriops tagal* and *Rhizophora mucronata* (Figs. 11 a-c). A major mono specific expansion of *A. marina* was recorded along the creeks except at the mouth where *C. tagal* and *R. mucronata* were found to be mixed. In general, tall mangroves were found either near the creek mouth or along the banks up to the middle. In other places, the mangroves had stunted growth and towards the northen side at elevated locations (~0.1-1.6 from spring high water level = ~5.5m), sparse distribution of salt marsh species was noticed (Fig.10)



(a) (b)

(c)

Figs 11 a-c. Mangrove species recorded at creeks in and around APSEZ(a) ***Avicennia marina*** **(b)** ***Ceriops tagal*** **(c)** ***Rhizophora mucronata***

c. Associated flora and fauna

Sparse and scattered distribution of salt marsh species, *Arthrocnemum indicum* and *Suaeda fruticosa* were recorded towards the landward side. Mangrove crabs were represented by *Uca annulipes*, *Metapograpsus mesor*, *Grapsusalb olineatus* and *Metaplax indica* (Fig.12). Birds such as *Threskiornis melanocephalus*, *Casmerodius albus*, *Myceteria leucocephala, Sterna aurantia and Vanellus indicus* were observed during the survey. Occurrence of crabs like *Uca* sp indicates that the existing mangrove ecosystem is healthy in terms of associated biodiversity.

Grapsusalbo lineatus *Uca sp*

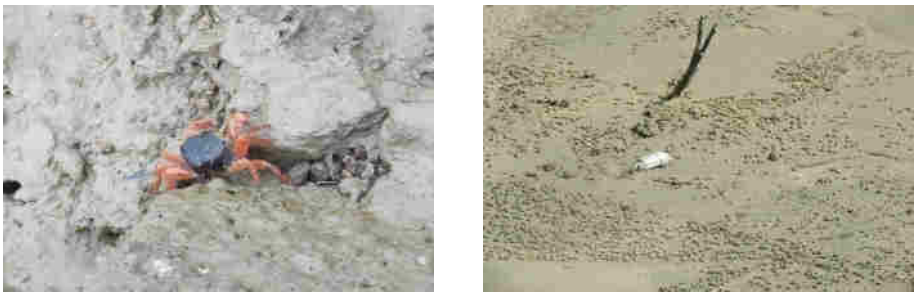


Fig.12. Associated fauna

d. Mangrove structure

The overall tree density for Bocha creek is 2700 individuals ha^{-1}. The basal cover and complexity index was found to be 39.48 m^2ha^{-1} and 22.7 respectively (Table 2). The Shannon-Wiener diversity (*H'*) and Simpson Dominance (*S*) was found to be low (0.48, 0.71). The recruitment of mangrove juveniles was found to be 5500 individuals ha^{-1}. The mean girth and height was estimated to be 0.35 ± 0.24 m and 1.97 ± 0.009 m respectively.

e. Issues

The major issues observed along the Bocha Island are given below:

(i) Despite the high tidal amplitude, there is less frequency of tidal inundation at north central part of the creek which is due to elevated topography (Example Location indicated in Fig.10 with elevation of 0.5 m more than spring high tide and photo in Fig. 13).

(ii) Erosion along the banks of the creek and tip of the Bocha island causing damage/loss of mangroves and sea facing mud flats (Fig.14).

Fig.13. Elevated north part of the Bocha island with growth of salt marsh vegetation (Lat. 22°46′06.31 N and Long. 69°41′35.06)

Fig. 14. Erosion of banks of Bocha island in the Bocha creek side with mangrove vegetation

f. Mitigation measures

The issue of no tidal inundation in elevated part of the island and erosion of banks are being analysed. Mathematical model simulating the existing topographic conditions with prevalent tidal range for such areas in the mangrove region in and around APSEZ is being developed to explore the possibility of reaching the tidal water in the area so that formation of mangrove vegetation will commence after appropriate interventions. Regarding the erosion at the tip of the island facing Gulf of Kachchh which has led to

loss of mangroves and mud flats compared to the previous years, it is understood that the cause of erosion might be alteration of the coastal processes prevailing in the nearshore waters. Therefore it is suggested that no further developmental and other activities that disturb/alter the coastal processes should be undertaken in the sea around the tip of the island and also along both Navinal and Bocha creeks adjoining the Bocha Island. This will avoid further loss of mangroves and mud flats by way of increased erosion. Remedial measures to prevent erosion of tip of island will be suggested after conclusion of modelling studies.

4.2.4. Navinal Creek

a. Creek location

This creek is situated on the western side of the Bocha Island and it dissects the Island and the existing Port of APSEZ (Fig.1). Several small sub-creeks/ branches are present, of which one connects the Bocha creek on the northern side.

b. Mangrove species composition

Three mangroves species namely *Avicennia marina*, *Ceriops tagal* and *Rhizophora mucronata* were recorded on the Bocha island banks of this creek. Like Bocha creek side of Bocha island, the species richness is heterospecific near the mouth and thereafter monospecific represented by *A. marina* up to the end of the creek on the eastern side. The mangroves along the banks are distinctly tall (≈5.5 m) but occupy only a 10 m wide stretch on the periphery followed by stunted mangroves inwards. The western side of the creek was covered with *A. marina* as a single stretch of ≈7 m width. The creek banks of Bocha island side were highly eroded near the creek mouth (Fig.15). New recruitment of *A. marina* (seedlings and established saplings) was found along the creek banks indicating commencement of natural regeneration of mangroves.

Fig. 15. Erosion of banks of Bocha island along the Navinal creek

c. Mangrove structure

The density of trees found here is 1566 individuals ha^{-1}. The basal cover and complexity index was estimated as 56.58 m^2ha^{-1} and 60.74 respectively (Table 2). Low diversity indices were recorded (*H'*, 0.17; *D*, 0.93). The recruitment of *A. marina* colonizing along the waterfront areas of the creek was calculated as 16,633 juveniles per hectare. The mean girth and height recorded were 0.62 ± 0.25 and 2.96 ± 0.007 respectively.

c. Associated flora and fauna

Sparse distribution of *Arthrocnemum indicum* was observed within this creek. The distribution of mangrove crabs such as *Metapograpsus messor*, *Metaplax indica*, *Uca annulipes*, *Grapsusalbo lineatus* were observed. Birds such as *Egretta gularis*, *Himantopus himantopus*, *Vanellus indicus* and *Casmerodius albus* were found foraging on the exposed banks.

d. Issues

The major issue was erosion of creek banks of Bocha island near the mouth of Navinal creek resulting in loss of frontline mangrove vegetation of Bocha Island (Fig.16)

Fig.16. Erosion of banks of Bocha island along Navinal creek

e. Mitigation measures

Recommendations for stabilisaton of banks of Navinal creek through appropriate interventions will be made after conducting mathematical modelling studies.

4.2.5. Khari creek

a. Creek location

Khari creek is ≈3.5 km in length and branched with two major and many small sub-creeks, located near Juna bander (Fishermen settlement) (Fig.1)

b. Mangrove species composition

The mangrove cover of the creek area is about 288 ha. The order of distribution of dense, sparse and scattered mangroves were 190 ha (66%), 40 ha (14%) and 56 ha (20%) as shown in Fig 17. A mono specific expansion of *Avicennia marina* is observed in the Khari creek along with very few *Rhizophora mucronata* species. Stunted and sparse distribution of *A. marina* was observed along the creek banks except the mouth, where

the mangroves are tall (≈4.5 m) and moderately dense. The creek mouth possesses a wide mudflat with the natural colonization of *A. marina*.

Fig.17 Mangrove cover of Khari creek

c. Associated flora and fauna

Salt marsh *Suaeda* sp. is moderately distributed in this creek. Mangrove crabs *Uca tetragonum*, *Uca* sp and *Metapograpsus messor* were recorded from this creek. Birds were represented by *Egretta gularis*, *Ardea cinerea*, *Platalealeu corodia*, *Myceterialeuco cephala*, *Corvus splendens* and *Himantopus himantopus*.

d. Mangrove structure

The tree density of the Khari creek was found to be 1,266 individuals per hectare. The basal cover and complexity index was estimated as 18.92 m^2 ha^{-1} and 11.11 respectively (Table 2). Due to the monospecies distribution of *A. marina*, the diversity indices were low (*H'* = 0; *D* = 1). Natural recruitment of *A. marina* was recorded as 8,500 juveniles per hectare. The mean girth and height of *A. marina* is 0.43 ± 0.13 and 4.54 ± 0.002 respectively.

e. Issues

The major issue observed in the Khari creek was cutting of Mangrove trees by human as evident from Photo at Fig 18, which may cause erosion of banks of Khari creek posing a threat to existence of mangrove vegetation.

Fig. 18. Erosion on the banks of Khari creek and cutting of mangrove vegetation

f. Mitigation measures

- The mangrove felling by human needs to be analysed and a suitable solution through stakeholder consultation to prevent such felling is necessary

4.3. Mangrove Health

a. Basal cover

Basal area is an indicator to measure the forest stand development and to understand species population, biomass and productivity in response to stress factors. The pristine mangrove forests with slight impacts will have a basal area of >25 m^2 ha^{-1}; secondary forest is found to have around 15 m^2 ha^{-1}; and disturbed forests havebasal areas of <10 m^2 ha^{-1}. Thus, results indicate that low stand of basal area recorded at Khari, Baradimata and Kotdi creeks are due to low structural development. In most of the creeks, *Avicennia marina* had better basal area coverage in comparison to other reported species. **The mangroves at Bocha and Navinal creeks can be classified as pristine mangroves.**

b. Complexity index

The complexity index is an integrative measure that combines a quantitative description of the floral and structural characteristics of mangrove vegetation. However, the mono species dominance causes the reduction in structural complexity and ecosystem services. Our findings revealed that Bocha island has the largest complexity index (60.74) owing to taller canopy and larger basal areas when compared with the mangroves documented along the other creeks. The low tree density and basal cover is an indication of the reduced structural complexity with disturbed conditions. For example, in Andaman mangrove forests, the complexity index ranged between 87.14-268.74 and 6.69-14.18 in undisturbed and disturbed forests respectively.

c. Regeneration potential

The quality of crop and productivity of forest stands determined by population growth, and is thus chiefly determined by seedling recruitment and survivorship. The evaluation of the regeneration potential involves assessment of seedling and sapling density, composition, sizes and the possibility of recruitment into the adult canopy. For adequate natural regeneration potential of a stand, the following criteria are required:

- ✓ a minimum of 2500 well distributed seedlings per hectare
- ✓ the total number of seedlings and saplings are > 50% of the number of mature trees per hectare

Field surveys by NCSCM revealed that all the mangrove stands in the creeks of Port and SEZ have adequate natural regeneration potential either as***'potential regeneration'*** (juvenile measuring <30 cm) or '***established regeneration'*** (30 cm to 1 m). However, erosion along the creek banks makes the seedlings starved, where the juveniles regenerate. Generally, seedling density is high outside the canopy cover since it requires regular inundation and sun light. Field observation exhibited that the regeneration potential was significant in *Avicennia marina* compared to *Rhizophora mucronata* or *Ceriops tagal* due to the monospecific expansion of *A. marina*. In mixed stands, regeneration potential is almost equal.

Due to the deeper depth at the mouth of the Baradimata creek , the natural colonization of mangroves along the front line areas is well established. However, the mouth should

be regularly monitored otherwise there is a chance of closing of mouth due to accretion/ sedimentation.

d. Species diversity

There are only three mangrove species *viz.*, *Avicennia marina*, *Rhizophora mucronata* and *Ceriops tagal* present in the creeks. *A. marina* is predominantly present in the creeks. Absence of a clear mangrove zonation pattern is witnessed in the creeks of Port and SEZ.

4.4. Associated species

Occurrence of wide range of associated fauna especially *Uca* sp indicates that associated faunal diversity around the dense mangrove environment is healthy.

5. Mitigation measures

5.1. Hydrology

The mangroves are highly sensitive to minor alterations in the hydrology of an area. Generally, regeneration takes place when the normal tidal hydrology is restored in elevated areas (for e.g., central part of Bocha creek, as indicated in Fig. 7) and the supply of seeds or propagules from adjacent stands is re-established. Mangroves can be established (restored in some areas) through meticulous hydrological corrections which will be suggested after completion of modelling studies.

6. Completion of remaining tasks

The tasks remaining are following

1. **Bathymetry maps with HTL and CRZ areas**
   The HTL data from satellite image will be plotted on the bathymetry map and verified with field HTL data collected at the time of bathymetry survey. The CRZ areas will also be mapped.
2. Finalising buffer in mangrove maps
3. **Preparation of integrated plan for conservation of mangroves and the creeks**

Using the mangrove maps prepared and elevation data obtained over sparse and scatter mangroves, based on field observations and mathematical modeling results, measures will be suggested to facilitate inflow of seawater to set a condition for growth of mangroves. The task of modeling is in progress.

As a part of the conservation plan, the extent of dependence on mangrove plants for fuel and fodder will be determined from the communities living around mangrove areas of APSEZ through Focus Group Discussion. The data will be used to suggest use of alternate methods against mangrove vegetation.

Annexure – 3

GPCB

GUJARAT POLLUTION CONTROL BOARD
PARYAVARAN BHAVAN
Sector-10-A, **Gandhinagar** 382 010
Phone : (079) 23222425
(079) 23232152
Fax : (079) 23232156
Website : www.gpcb.gov.in

By R.P.A.D.

In exercise of the power conferred under section-25 of the Water (Prevention and Control of Pollution) Act-1974, under section-21 of the Air (Prevention and Control of Pollution)-1981 and Authorization under rule 6(2) of the Hazardous & Other Waste (Management & Transboundary Movement) Rules-2016, framed under the Environmental (Protection) Act-1986.

And whereas Board has received application inward No.**123578** dated **22/08/2017** for the **Consolidated Consent and Authorization** (CC&A) of the Board under the provisions / rules of the aforesaid Acts. Consents & Authorization are hereby granted Consent to operate for Development of Multi Product SEZ for SEZ (1st Phase) at Mundra, Dist-Kutch as under:

CONSENTS AND AUTHORISATION:
(Under the provisions /rules of the aforesaid environmental acts)

To :
Adani Ports & SEZ Limited
Notified SEZ area,
Tal: Mundra, Dist: Kutch– 370421

1. Consent Order No. AWH- 88998 Date of Issue: 26/10/2017

The consent shall be valid up to 21/08/2022 for Development of Multi Product SEZ (Phase-I) for common infrastructure facilities like Processing-Non processing zone, Ware housing zones, Road & Rail networks (trunk as well as Internal), Bridges or culverts, IT-Telecommunication Electric network, Effluent collection network & utilities & supporting infrastructure, Sewage Treatment Plant (150 KL/ Day), two DG sets (750 KVA and 500 KVA) within Multiproduct SEZ of 8481.27 Hectares of SEZ (at Mundra), Dist-Kutch

2. SUBJECT TO THE FOLLOWING SPECIFIC CONDITIONS:

2.1 Unit shall comply with all conditions stipulated by MoEF & CC in order of Environment Clearance vide. F.NO. 10-138/2008-IA.III dated 15/07/2014

2.2 Unit shall apply for Necessary permission for your proposed common infrastructure facilities like Desalination plant (150 MLD), sea water intake & out fall facility (375 MLD intake & 241 MLD out fall) CETP-50 MLD, STP-62 MLD as well as Municipal solid waste site & free trade & ware house zone (FTWZ) before installation & commissioning of plant.

2.3 All industrial Units located in Mundra SEZ Limited shall be given separate treatment for generated their ww in their plant & dispose of treated industrial waste water as per consent granted by board to individual respective unit

2.4 Unit shall adhere to all consent conditions granted to their existing common effluent treatment facilities (CETP) (2.5 MLD) (ID-10605), sewage treatment plant (total capacity 2.5 MLD) ((D-10602) & dispose treated water as per consent granted to them by board.

2.5 Unit shall adhere to the final judgment of Hon'ble High Court vide Writ Petition (PIL) No 122 of 2013 & others linked petitions with it.

2.6 Unit shal adhere to all conditions of CTE issued vide order No GPCB/CCA-KUTCH-1044/ ID-31469/ 109800 dated 16.4.2012

2.7 Unit shall comply all conditions of CRZ Clearance Recommended by Department of Forest and Environment Government of Gujarat vide letter number ENV-10-2012-1601-E dated 27-03-2012.

2.8 Unit shall adhere to all conditions of Free Trade Ware housing Zone (FTWZ) issued by Ministry of commerce and Industry, Department of commerce (SEZ section) vide order No F 1/16/2011 SEZ dated 4.1.2012.

3. CONDITIONS UNDER WATER ACT 1974:

3.1 Total domestic water requirement for horticulture is 500 KLD shall be used within SEZ area having 96 ha area.

3.2 The quantity of Sewage effluent shall not exceed 150 KL/day & is sent to STP for its treatment.

3.3 he quality of the sewage shall conform to the following standards

PARAMETERS	GPCB NORMS
pH	6.5 to 9
BOD (5 days at 20° C)	30 mg/L
Suspended solids	100 mg/L
Fecal Coliform	1000

3.4 Treated domestic effluent confirming to the prescribed norms shall be utilized on land for gardening and plantation within premises through fixed pipeline network in SEZ area.

3.5 The unit shall install meters at utilities for measuring category wise (Category as given in Schedule II of "Water (Prevention & Control of Pollution) Cess Act 1977") consumption of water.

4. CONDITIONS UNDER AIR ACT 1981:

4.1 The following shall be used as fuel in D.G Sets respectively.

Sr. No.	Fuel	Quantity
1.	HSD	200 Ltr/ hr

4.2 The applicant shall install & operate air pollution control system in order to achieve flue gas emission norms as prescribed below,

Sr. No.	Stack attached to	Stack height in Meter	Parameter	Permissible Limit
1	D. G. sets (750 KVA & 500 KVA) (standby)	4 each	PM SO_2 NOx	150 mg/Nm^3 100 ppm 50 ppm

4.3 There shall be no process gas emission from manufacturing process and other ancillary operations.

4.4 The concentration of the following parameters in the ambient air within the premises of the industry shall not exceed the limits specified hereunder as per National Ambient Air Quality Standards issued by MOEF & CC dated 16th November-2009.

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient air in µg/M³
1.	Sulphur Dioxide (SO_2)	Annual	50
		24 Hours	80
2.	Nitrogen Dioxide (NO_2)	Annual	40
		24 Hours	80
3.	Particulate Matter (Size less than 10 µm) OR PM_{10}	Annual	60
		24 Hours	100
4	Particulate Matter (Size less than 2.5 µm) OR $PM_{2.5}$	Annual	40
		24 Hours	60

4.5 The applicant shall provide portholes, ladder, platform etc at chimney(s) for monitoring the air emissions and the same shall be open for inspection. The chimney(s) vents attached to various sources of emission shall be designed by numbers such as S-1, S-2, etc. and these shall be painted / displayed to facilitate identification.

4.6 The concentration of Noise in ambient air within the premises of industrial unit shall not exceed following levels:

Between 6 A.M. to 10 P.M.: 75 dB (A)
Between 10 P.M. to 6 A.M.: 70 dB (A)

5. Authorization under Hazardous and other waste [Management, Transboundary Movement] Rules, 2016 & amended.

5.1 **Authorization Number: AWH – 88998 and shall valid up to 21/08/2022.**

5.2 Adani Ports & SEZ Limited, Notified SEZ area, Tal: Mundra, Dist: Kutch– 370421 is hereby granted an authorization to operate facility for following hazardous wastes on the premises situated at. Plot No- Notified SEZ area, Tal: Mundra. Dist: Kutch– 37042'

Sr. No.	Waste	Quantity per Month	Category	Mode of Disposal
1.	Used Oil	0.5 MT	5.1	Collection, storage and Reuse as a lubricant within a unit premises and / or sold out to registered recyclers.

6.3 The authorization is subject to the conditions stated below and such other conditions as may be specified in the rules from time to time under the Environment (Protection) Act-1986.

6. GENERAL CONDITIONS OF AUTHORIZATION:

1 The authorized person shall comply with the provisions of the Environment (Protection) Act, 1986, and the rules made there under.

2 The authorization or its renewal shall be produced for inspection at the request of an officer authorized by the State Pollution Control Board

3. The person authorized shall not rent, lend, sell, transfer or otherwise transport the hazardous and other wastes except what is permitted through this authorization.
4. Any unauthorized change in personnel, equipment or working conditions as mentioned in the application by the person authorized shall constitute a breach of his authorization.
5. Hazardous Waste generated shall be disposed off in accordance with the Hazardous Waste & other waste (Management & Transboundary Movement) Rules, 2016 as amended and unit shall have to obtain authorization of the Board for all applicable categories of Hazardous wastes.
   (a) Used oil / spent oil shall be disposed off by selling it to registered re- refiner units only
   (b) Oily sludge from separators shall be dispose or of selling it to registered re- refiners unit only
   (c) ETP sludge shall be disposed of at TSDF approved by the Board
   (d) Used batteries shall be sold to the GPCB authorized dealers.

6. The person authorized shall implement Emergency Response Procedure (ERP) for which this authorization is being granted considering all site specific possible scenarios such as spillages, leakages, fire etc. and their possible impacts and also carry out mock drill in this regard at regular interval of time,

7. It is the duty of the authorized person to take prior permission of the State Pollution Control Board to close down the facility.

8. The imported hazardous and other wastes shall be fully insured for transit as well as for any accidental occurrence and its clean-up operation.

9. The record of consumption of hazardous and other wastes shall be maintained.

10. The hazardous and other waste which gets generated during recycling or reuse or recovery or pre-processing or utilization of imported hazardous or other wastes shall be treated and disposed of as per specific conditions of authorization

11. An application for the renewal of an authorization shall be made as laid down under these Rules.

12. Annual return shall be filed by June 30th for the period ensuring 31st March of the year.

7. GENERAL CONDITIONS

7.1 Any change in personnel, equipment or working conditions as mentioned in the consents form/order should immediately be intimated to this Board.

7.2 The waste generator shall be totally responsible for (i.e. Collection, storage, transportation and ultimate disposal) of the wastes generated.

7.3 Records of waste generation, its management and annual return shall be submitted to Gujarat Pollution Control Board in Form – 4 by 31st January of every year.

7.4 In case of any accident, details of the same shall be submitted in Form – 5 to Gujarat Pollution Control Board.

7.5 Applicant shall comply relevant provision of "Public Liability Insurance Act – 91"

7.6 Empty drums and containers of toxic and hazards material shall be treated as per guideline published for "management & handling of discarded containers". Records of the same shall be maintained and forwarded to Gujarat Pollution Control Board regularly.

7.7 Adequate plantation shall be carried out all along the periphery of the industrial premises and a green belt of 10 meters width is developed.

7.8 The applicant shall however, not without the prior consent of the Board bring into use any new or altered outlet for the discharge of effluent or gaseous emission or sewage waste from the proposed industrial plant. The applicant is required to make applications to this Board for this

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purpose in the prescribed forms under the provisions of the Water Act-1974, the Air Act-1981 and the Environment (Protection) Act-1986

7.9 The over all noise level in and around the plant area shall be kept well within the standards by providing noise control measures including engineering control like acoustic insulation hoods, silencers, enclosures etc on all sources of noise generation. The ambient noise level shall conform to the standards prescribed under the Environment (Protection) Act, 1986 & Rules.

7.10 The concentration of Noise in ambient air within the premises of industrial unit shall not exceed following levels:

Between 6 A.M. and 10 P.M.: 75 dB (A)
Between 10 P.M. and 6 A.M.: 70 dB (A)

7.11 In case of transport of hazardous waste to a facility for (i.e. Treatment, Storage and disposal) existing in a state other than the state where hazardous waste are generated, the occupier shall obtain "No Objection certificate" from the state pollution Control Board, the Committee of the concerned state or Union territory Administration where the facility exists.

7.12 Unit shall take all concrete measures to show tangible results in waste generation reduction, voidance, reuse and recycle. Action taken in this regards shall be submitted within 03 months and also along with Form 4

7.13 You shall have to display the relevant information with regard to hazardous waste as indicated in the Hon. Supreme Court's order in W.P. No.657 of 1995 dated 14th October 2003

7.14 Industry shall have to display on-line data outside the main factory gate with regard to quantity and nature of hazardous chemicals being handled in the plant, including wastewater and air emissions and solid hazardous waste generated within the factory premises.

For and on behalf of
Gujarat Pollution Control Board

(P.J. Vachhani)
Senior Environmental Engineer

NO: PC/ CCA- KUTCH- 1044/GPCB ID: 31463/ **Date:**

ISSUED TO:
Adani Ports & SEZ Limited
Notified SEZ area,
Tal: Mundra, Kutchh,
Dist: Kutch– 370421

Annexure – 4

Annexure – 4

List of CETP Member Units

Sr. No.	Name of the Member Unit (Industrial Effluent)	Booked Qty. KLD
1	M/s. Dorf Ketal Speciality Catalyst Pvt. Ltd.	60
2	M/s. Ahlstrom Fiber composites India Pvt. Ltd.	25

Sr. No.	Name of the Member Unit (Domestic Sewage)
1	M/s. Skaps Industries India (Pvt.) Ltd.
2	M/s. Skaps Industries India (Pvt.) Ltd. (Unit II)
3	M/s. Mundra SEZ Integtaed Textile Apprel Park Ltd. (MITAP) – Common Facility
4	M/s. GSPC LNG Ltd.

Annexure – 5

Completion Report on Mangrove Plantation

Tada talav village, Khambhat taluka, Anand district, Gujarat, India
Area Covered : 100 hectares

Project Period:

August 2015 to March 2017

Service Order No: 4800014042

Project Implemented for:

Adani Ports And Special Economic Zone Limited (APSEZ)

Project Implemented by:

SAVE – Saline Area Vitalization Enterprise Limited

I. Introduction

APSEZ assigned SAVE Ltd. to carry out mangrove plantation in 100 hectares of coastal land at village Tada talav located in Khambhat taluka of Anand district, Gujarat.

SAVE Ltd distributed the whole plantation in to three -03 Phases.

I. Identification of probable sites for mangrove plantation.
II. Plantation in 100 hectares of coastal land.
III. Maintenance & gap filling of 100 hectares of coastal land.

II. Identification of site

During this phase many locations were identified along the coast of Southern Gujarat. While searching for these locations our main criteria for finalizing a site was type of soil strata suitable for mangrove plantation, land availability (we were searching for a vast area that would measure up to 100 hectares) and support from the local community.

Methodology for Identification

- Surveying the coastal belt.
- Understanding the soil condition.
- Measuring the land with GPS
- Mapping the land.
- Organizing meetings leaders from the local community.
- Creating awareness about mangrove plantation at community level.
- Arrange for a joint visit with the client
- Finalizing the site.

Eight (08) sites were finalized and a detailed report was prepared. Out of these eight, site at village Tadatalav, taluka Khambhat, District Anand was finalized after consultation and a joint site visit with APSEZ officials.

III. Location:

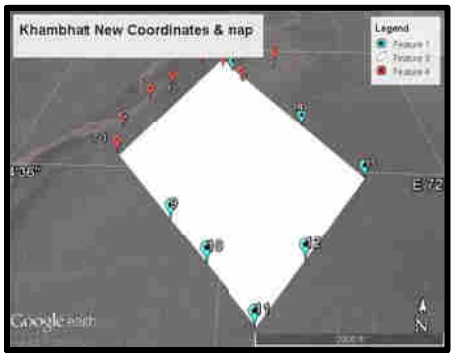
Tadatalav is a Village in Khambhat Taluka in Anand District of Gujarat State, India. It is located 40 KM towards South from District head-quarters Anand, 115 KM from State capital Gandhinagar. The latitude 22.6188935 and longitude 70.9521881 are the geo coordinates of the Tadatalav. Tadatalav is surrounded by Borsad Taluka towards North, Petlad Taluka towards North, Tarapur Taluka towards North, Sojitra Taluka towards North.

No	Taluka			Village	Location	Coordinates	Remarks
1	Khambhat	Tada Talav	Entering point at the site	N-22.15.24.8	There is an approximate 150 hectares of area suitable for mangrove plantation.		
				E-072.25.39.4			

Google image showing the area

IV. Measurement & mapping

After the visit the area was mapped by GPS. The coordinates were mapped and measured to an approximation of hundred hectares. These coordinates were then projected on Google maps.



Google map of the site measuring 100 ha

No	Coordinates	No	Coordinates
1	22°15'26.48"N	5	22°15'34.84"N
	72°25'4.47"E		72°25'34.61"E
2	22°15'19.84"N	6	22°15'46.64"N
	72°25'10.23"E		72°25'25.85"E
3	22°15'12.35"N	7	22°16'3.83"N
	72°25'16.78"E		72°25'12.60"E
4	22°15'20.76"N	8	22°16'7.12"N
	72°25'23.63"E		72°25'10.02"E

V. Details of the project Area

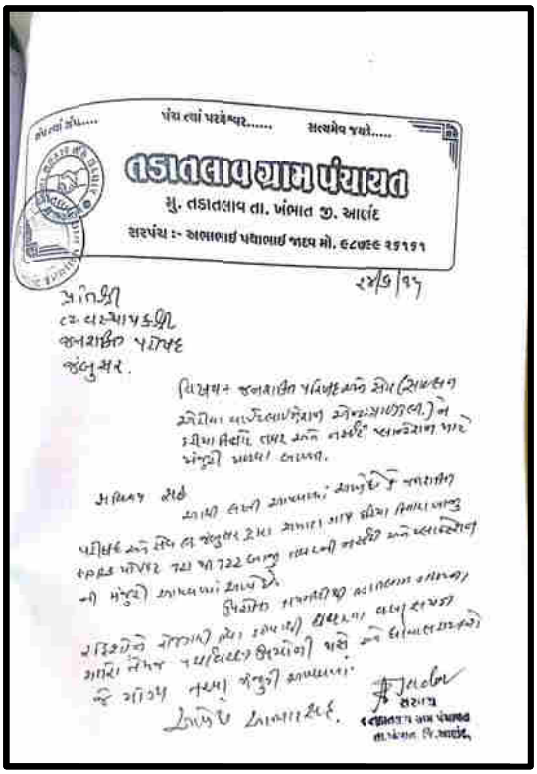
Location	Village Tadatalav , taluka Khambhat, district Anand
Coordinates	N- 22.15.24.8 E- 072.25.39.4
Area	100 hectares
Topography	Mudflats
Soil Ph	8.4
Average rainfall	23 mm
Salinity	Alkaline
Land elevation	Flat plain 6 Mt
Sedimentation	5-7 cm/annum
Dominant species	Avicenna marina
Source of propagules	Available within 05 km of mangrove plantation site
Available propagules	Avicenna marina

VI. Community Mobilization

After having understood the technical facts, and mapping the area, next step was to carry out a baseline survey of the village. A detailed survey was carried out at village level.

While carrying out the survey numbers of meetings were held with local community leaders. During these meetings importance of mangroves along the coast was discussed, we also discussed how this project will benefit their village by providing economic and environmental development. The leaders were convinced & assured their cooperation.

The panchayat issued a letter of agreement to the CBO – Jan Shakti parishad stating their support for the plantation project.



VII. Samiti (CBO) Formation

Next step was to form the mangrove plantation committee. The committee was formed with agricultural laborers of the village. We worked with this community to plant mangroves. The group was trained in nursery formation, direct dibbling & Plantation of mangrove plants. A Tavar Vikas Samiti was formed, which carried out mangrove plantation.

VIII. Planning at the site for mangrove Plantation

The whole process of nursery formation & plantation was planned. Points considered during the planning were:

1. Quality of Mudflats(to define in which area to carry out nursery plantation & Direct dibbling)
2. Existing naturally grown mangroves
3. Rainfall during Monsoon
4. Rising sea level during high tide
5. Violent sea actions

After thorough study of the area, the plantation was planned as below

Activity	Area in ha
Nursery formation	70 ha
Direct dibbling	30 ha

In order to plant 3000 plants per hectare, we developed the nursery of 3,750 plants per ha. For planting mangroves in seventy ha. (70 ha) – i.e. **70 ha x 3750 = 2,62, 500** saplings Beds measuring 6x100 bags was formed across the area. Direct dibbling in remaining 30 ha. was carried out during the month of September- October 2015

IX. Initiation of the work

The work was initiated in the month of August 2015, after obtaining a formal work order from APSEZ.

X. Seed Collection

The seeds were collected from the naturally grown mangroves at the location. But those seeds were not enough for nursery formation and direct dibbling. Hence more seeds were transported from village Nada, in Jambusar taluka Bharuch district. Almost 600 – 700 kg of seeds were used for nursery formation and direct dibbling.

XI. Nursery Formation

Nursery formation was carried out during the monsoon months.

A. Methodology followed:

1. Identification of area to construct beds for nursery formation.
2. Measuring the area and creating a bed along the site border.
3. Punching of bags & soil filling.
4. Sowing of seeds in the bags.

XII. Direct Dibbling was carried out during the months of September – October.

A. Methodology followed:

1. Seeds were collected and germinated in a manmade pond.
2. After the germination they were sowed directly in to the ground.
3. Initially a line was drawn using a thread, to ensure a straight line plantation.
4. The seeds were then sown parallel to this line

XIII. Difficulties faced

During monsoon, due to heavy flooding of rivers like Sabarmati, Narmada, Mahi & Tapi which flows in to Gulf of Khambhatt, there was a substantial water level rise which lead to erosion of mudflats along the site area. Hence the land had become more sandy and hard. Because of this we faced difficulty in nursery formation and direct dibbling.

After heavy monsoon the state experienced a dry period during which the seeds in the nursery got burnt because of insufficient water supply and harsh sun.

Because of the above mentioned problems, It was decided to form nursery at village Nada of Jambusar taluka, Bharuch district. The plants were then transported by boat to Tadatalav

Pictures showing high erosion






XIV. Deviation from the original plan

Because of the difficulties faced, this season we were not able to reach our target in nursery formation of 2, 65,000 nursery plants, instead we were able to form nursery to the number of 1, 65,000.

In the first year, though 100 ha. plantation was planned and initiated, unfortunately due to natural conditions of the project site, which witnessed heavy soil erosion, only 50% (52 ha.) of the plantation survived. (Site – 01– google map & GPRS Points attached)

After deliberations it was decided that the remaining 48 ha. would be carried out during the year 2016-17. (Site – 02 – google map & GPRS Points attached)

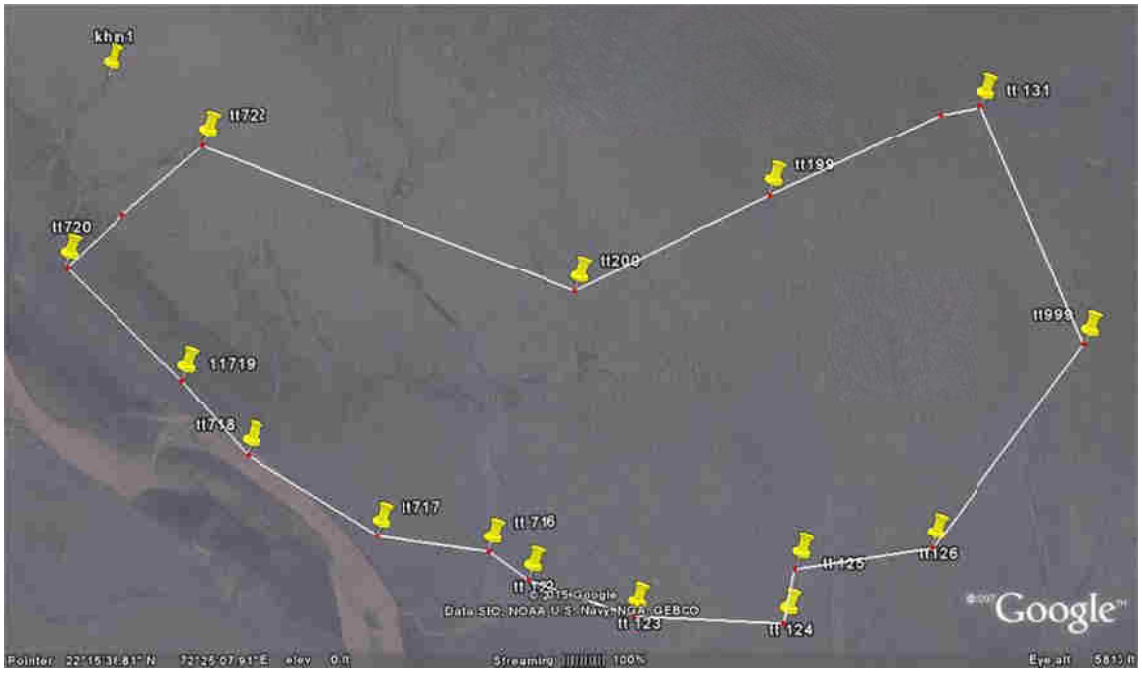
The targeted area of 48 ha. was divided into two parts i.e. part – 1 of 35 ha. to be carried out through plants from nursery and remaining part – 2 of 13 ha. through direct dibbling. In view of the above, a nursery for 1,40,000 plants was established. Further plantation through direct dibbling was carried out in 08 ha. area.

During the month of March 2017 plantation through nursery plants was carried out. Totally 1,20,000 plants were planted.

With this the project of planting 100 ha. of mangroves has been completed.

Google MAPS
&
GPRS Points

Map & GPRS Points for the 1st site selected

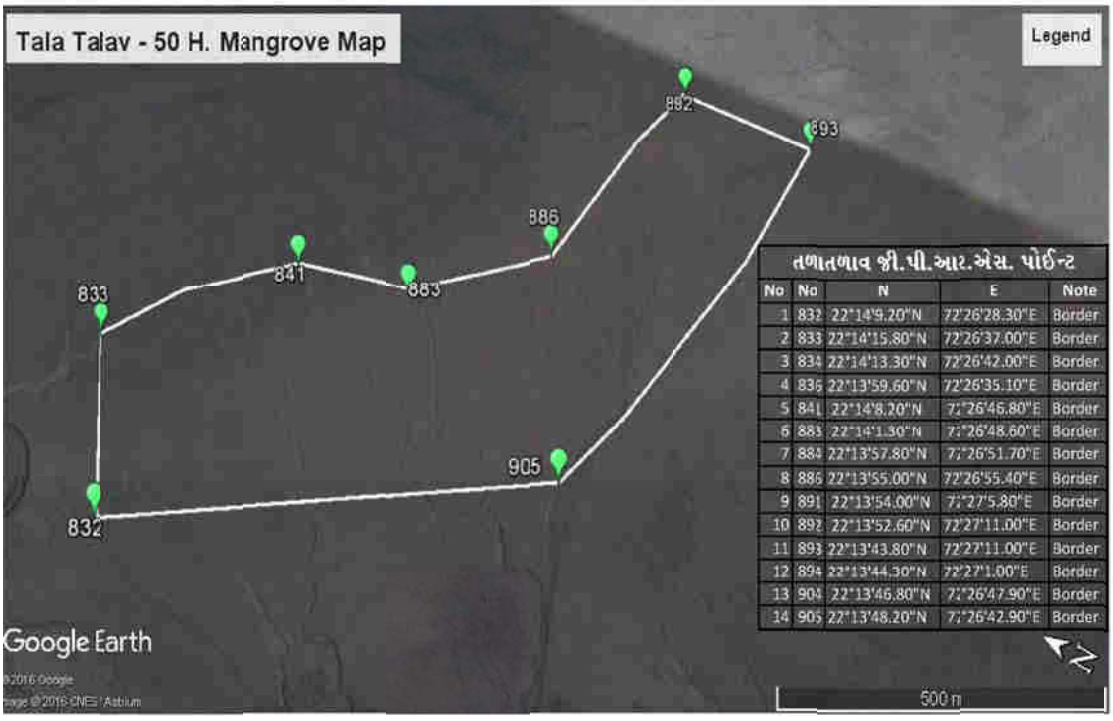


GPRS Points of Tada Talav Mangrove Plantation Site

No.	Particulars	No	GPRS Points	
1	Sea Side Creek	716	N- 22.15.38.9	E- 072.24.53.5
2	Vadgam Side Creek	717	N- 22.15.45.4	E- 072.24.52.9
3	Vadgam Side Creek	718	N- 22.15.53.9	E- 072.24.56.1
4	Vadgam Side Creek	719	N-22.15.58.5	E- 072.24.59.8
5	Vadgam Side Creek	720	N- 22.16.06.6	E- 072.25.05.1
6	Tada Talav Side Creek	722	N- 22.16.00.3	E- 072.25.14.6
7	Sea Side Creek	122	N- 22.15.36.3	E- 072.24.52.3
8	Sea Side Creek	123	N- 22.15.29.8	E- 072.24.51.5
9	Sea Side	124	N-22.15.21.1	E- 072.24.53.2
10	Sea Side	125	N- 22.15.21.1	E- 072.24.56.8
11	Sea Side	126	N- 22.15.13.7	E- 072. 24.59.9
12	Mangrove Side Border	131	N- 22.15.16.4	E- 072.25.27.6
13	Mangrove Side Border	199	N- 22.15.27.3	E- 072. 25.19.3
14	Mangrove Side Border	200	N- 22.15.37.1	E- 072.25.10.6
15	Mangrove Side Border	999	N- 22.15.07.5	E- 072.25.14.4

Site -01

Site – 02



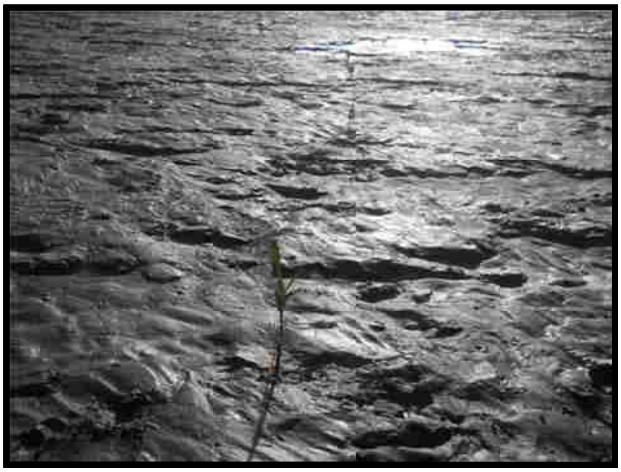
Pictures

Site Selection - Field Visit

Seed Collection

Nursery Formation

Direct Seed Sawing



Plantation

Annexure – 6

Details of Greenbelt development at APSEZ, Mundra

LOCATION	Total Green Zone Detail				
	Area (In Ha.)	Trees (Nos.)	Palm (Nos.)	Shrubs (SQM)	Lawn (SQM)
SV COLONY	65.34	30051.00	6965.00	51138.00	80069.00
PORT & NON SEZ	77.52	131942.00	18613.00	68166.78	58455.18
SEZ	99.52	227135.00	15924.00	220449.60	27462.03
MITAP	2.48	8168.00	33.00	1670.00	4036.00
WEST PORT	83.20	182118.00	50221.00	24112.00	22854.15
AGRO- PARK	7.52	17244.00	1332.00	5400.00	2121.44
SOUTH PORT	14.08	25150.00	3430.00	3882.00	4826.97
Samudra Township	38.67	28252.00	11818.00	19978.07	35071.67
Productive Farming	15.69	19336.00	0.00	0.00	0.00
TOTAL (APSEZL)	**404.02**	**669396.00**	**108336.00**	**394796.45**	**234896.44**
		7,77,732			

Details of Mangrove Afforstation done by APSEZ

Sl. no.	Location	Area (ha)	Duration	Species	Implementation agency
1	Mundra Port	24.0	-	Avicennia marina	Dr. Maity, Mangrove consultant of India
2	Mundra Port	25.0	-	Avicennia marina	Dr. Maity, Mangrove consultant of India
3	Luni/Hamirmora (Mundra, Kutch)	160.8	2007 - 2015	Avicennia marina, Rhizophora mucronata, Ceriops tagal	GUIDE, Bhuj
4	Kukadsar (Mundra, Kutch)	66.5	2012 - 2014	Avicennia marina	GUIDE, Bhuj
5	Forest Area (Mundra)	298.0	2011 - 2013	Avicennia marina	-
6	Jangi Village (Bhachau, Kutch)	50.0	2012 - 2014	Avicennia marina	GUIDE, Bhuj
7	Jakhau Village (Abdasa, Kutch)	310.6	2007-08 & 2011-13	Avicennia marina, Rhizophora mucronata, Ceriops tagal	GUIDE, Bhuj
8	Sat Saida Bet (Kutch)	255.0	2014-15 & 2016-17	Avicennia marina & Bio diversity	GUIDE, Bhuj
9	Dandi Village (Navsari)	800.0	2006 - 2011	Avicennia marina, Rhizophora mucronata, Ceriops tagal	SAVE, Ahmedabad
10	Talaza Village (Bhavnagar)	50.0	2011-12	Avicennia marina	SAVE, Ahmedabad
11	Narmada Village (Bhavnagar)	250.0	2014 - 2015	Avicennia marina	SAVE, Ahmedabad
12	Malpur Village (Bharuch)	200.0	2012-14	Avicennia marina	SAVE, Ahmedabad
13	Kantiyajal Village (Bharuch)	50.0	2014-15	Avicennia marina	SAVE, Ahmedabad
14	Devla Village (Bharuch)	150.0	210-16	Avicennia marina	SAVE, Ahmedabad
15	Village Tala Talav (Khambhat, Anand)	100.0	2015 - 2016	Avicennia marina	SAVE, Ahmedabad
16	Village Tala Talav (Khambhat, Anand)	38.0	2015 - 2016	Avicennia marina	GEC, Gandhinagar
	Total Mangrove Plantation:	**2827.90 Ha**			

Annexure – 7

A. Green Development at APSEZL,Mundra (Till Nov.2017) as per EC

Green Belt Developed as per EC Condition

Sr No.	Symbol	EC	Ec Details	Locations	Green Belt (ha.)	Trees (No.)	Average Tree Density (ha.)
GB1		23.Au.1995	Handling facility of General cargo/LPG/Chemical and their storage terminal at Navinal Island	Navinal island, Liquid area	15.15	51605	3406
GB2		20.Sept. 2000	Port Expantion project including dry/bulk/break bulk cargo/container terminal ,Rly Link , related ancillary and back up	Intide port,Avenue, Fire station,Rly building, CTZ area,etc	13.66	18074	1323
GB3		21.July 2004	SPM,COT and connected pipeline at mundra port.	IOCL/HPCL /HMPL area	6.1853	7607	1230
GB4		05.Feb.2007	Development of Multipurpose berth(T2),Mundra	Terminal 2	4.37	5988	1370
GB5		12.Jan.2009	Waterfront development project at mundra	Waterfront area (Adani hou and nearer area,South and west basin,APL Roadetc)	122.36	281819	2303
GB6		20.Feb.2010	Esiablisment of CETP (17MLD) capacity at survey no.141(part),mundra	CETP area and treated water utilizations area	16.98	31083	1831
GB7		20.Feb.2010	Township and area Development project at survey no.141(Part),Mundra	Samudra township , Adani hospital,Periffery of Bhukhi river bank,etc	43.55	59166	1359
			(A.)Total		**222.25**	**455342**	**2049**

Additional Green Belt Developed

B. Additional Green Development at APSEZL,Mundra (Till Nov.2017)

Sr No.		Area Details	Green Belt (ha.)	Trees(No.)	Tree Density (ha.)
GB8		Shantivan colony ,Adani School,Temple,Guest houses,Mundra	65.34	40554	621
GB9		Mitap and nearer area	2.4	8168	3403
GB10		Agripark area	7.52	17244	2293
GB11		Airstrip and airstrip road ,Along road from Rly Gate 2-4 to 25,North gate & other SEZ area	88.79	243059	2737
GB12		New Development (area 1 to 13 ,A,B)	26.03	38625	1484
		(B.)Total	**190.08**	**347650.00**	**1828.97**

Total Green Development at APSEZL,Mundra (Till Nov.2017)

Sr No.	Area Details	Green Belt (ha.)	Trees (No.)	Tree Density (ha.)
	A+B	**412.34**	**802992.00**	**1947.42**

Mangrove Afforestation Till Nov.-2017

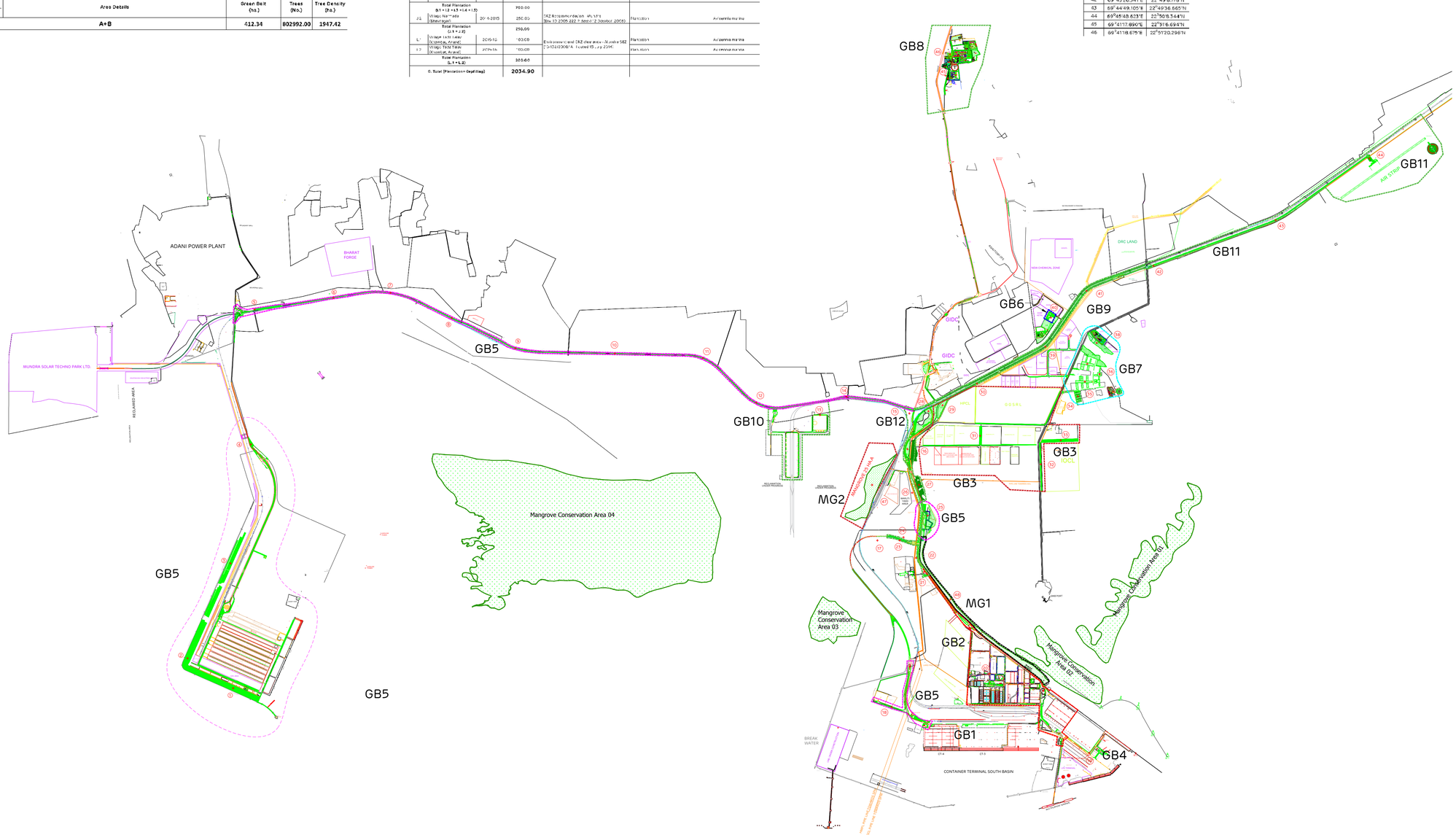
S. NO.	Location	FY	Area (Hectare)	Clearance Reference	Plantation/Gap Filling	Species
A1	Mundra Port Area (Mundra, Kutch)		24.00	Environment Clearance - Mundra (J-11011/57/95- A II dated 25 Aug.1995)	Plantation	Avicennia marina
	Total Plantation		**24.00**			
B.1	Mundra Port Area (Mundra, Kutch)		25.00	Environment Clearance - Mundra (J-11011/57/2003-IA II (M) dated 31 July 2004)	Plantation	Avicennia marina
	Total Plantation		**25.00**			
C.1	Luni, Mundra (Mundra, Kutch)	2007-08	10.00	CRZ Recommendation - 4th, 10/12/2006 to be a letter & changeover to be a letter 2 (No.11011/57/2005-IA II (I) dated 17 October 2006)	Plantation	Avicennia marina Rhizophora mucronata Ceriops tagal
C.2		2009-10	10.00		Gap Filling 90%	
C.3		2009-10	10.00		Gap Filling 90%	
C.4		2011-12	95.40		Plantation	
C.5		2012-13	24.40		Plantation	
C.6		2013-14 to 15	70.00		Gap Filling 90%	
	Total Plantation (C.1+C.4+C.5)		**160.80**			
D.1	Mundra (Mundra, Kutch)	2012-13	96.50	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	Avicennia marina
D.2		2013-14	10.00		Gap Filling 90%	Avicennia marina
	Total Plantation (D.1)		**96.50**			
E.1	Forest Area (Mundra)	2011-12	53.00	Forest Clearance - Ahmedabad (F.6.6.8/2/1999-FC (pt) dated 27 February 2006)	Plantation	Avicennia marina
E.2		2012-13	248.00		Plantation	Avicennia marina
	Total Plantation (E.1+E.2)		**298.00**			
S. NO.	Location	FY	Area (Hectare)	Clearance Reference	Plantation/Gap Filling	Species
F.1	Jangi village (Bhadreshwar, Kutch)	2012-13	33.00	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	Avicennia marina
F.2		2013-14	27.00		Gap Filling 90%	Avicennia marina
	Total Plantation (F.1)		**59.00**			
G.1	Jakhau Village (Abdasa, Kutch)	2007-08	40.10	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	Avicennia marina Rhizophora mucronata Ceriops tagal Note:- Width during the Commencing of mangroves in 1254 Sq. area as per Satellite Pic delineated during and vicinity part visibility.
G.2		2008-09	10.30		Gap Filling 90%	
G.3		2009-10	10.00		Gap Filling 90%	
G.5		2013-14	27.00		Gap Filling 90%	
G.6		2012-13	33.00		Gap Filling 90%	
G.7		2012-13	20.50	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006) Environment Clearance - Mundra (J-11011/200/2004-IA II (M), dated 15th, Jan.2006)	Plantation	
G.8		2012-13	200.00		Plantation	
G.9		2013-14 to 15	33.00		Gap Filling 90%	
	Total Plantation (G.1 + G.4 + G.7 + G.8)		**260.80**			
S. NO.	Location	FY	Area (Hectare)	Clearance Reference	Plantation/Gap Filling	Species
I.1	Village Candi (Gandhidham)	2006-07	200.00	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	
I.3		2007-08	100.00		Plantation	Avicennia marina
I.4		2008-09	200.00	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	Rhizophora mucronata Ceriops tagal
I.5		2010-11	100.00		Plantation	
	Total Plantation (I.1 + I.3 + I.4 + I.5)		**600.00**			
J.1	Village Narmada (Mandvi, Kutch)	2014-2015	250.00	CRZ Recommendation - 4th, 10/12 (No.11-2305-222-? dated 12 October, 2006)	Plantation	Avicennia marina
	Total Plantation (J.1 + J.2)		**250.00**			
L.1	Village Tuna Tekra (Khambhat, Kutch)	2015-16	100.00	Environment and CRZ clearance - Mundra SEZ (J-11011/200/2004-IA II (M) dated 15 July 2014)	Plantation	Avicennia marina
L.2	Village Tuna Tekra (Khambhat, Kutch)	2015-16	100.00		Plantation	Avicennia marina
	Total Plantation (L.1 + L.2)		**200.00**			
	G. Total (Plantation+ Gapfilling)		**2034.90**			

Lat Long Of Green Belt Area

Sr. No.	Latitude	Longitude
1	69°33'29.798"E	22°46'58.842"N
2	69°33'2.398"E	22°45'14.345"N
3	69°33'32.735"E	22°46'17.109"N
4	69°33'44.520"E	22°47'20.650"N
5	69°33'41.090"E	22°48'43.396"N
6	69°34'31.981"E	22°48'50.120"N
7	69°35'11.005"E	22°48'34.268"N
8	69°35'58.337"E	22°48'36.597"N
9	69°36'38.620"E	22°48'19.674"N
10	69°37'14.608"E	22°48'16.751"N
11	69°38'35.659"E	22°48'14.104"N
12	69°39'12.518"E	22°47'46.137"N
13	69°39'51.726"E	22°47'39.717"N
14	69°40'10.522"E	22°47'50.513"N
15	69°40'48.508"E	22°47'45.312"N
16	69°40'47.610"E	22°47'18.746"N
17	69°40'28.982"E	22°46'29.237"N
18	69°40'38.406"E	22°44'44.679"N
19	69°42'43.751"E	22°44'17.492"N
20	69°40'47.412"E	22°44'57.528"N
21	69°40'56.317"E	22°46'8.039"N
22	69°40'50.035"E	22°46'13.077"N
23	69°40'42.589"E	22°46'28.874"N
24	69°40'43.374"E	22°46'32.176"N
25	69°41'0.640"E	22°46'58.096"N
26	69°40'50.601"E	22°46'53.156"N
27	69°40'54.883"E	22°47'3.674"N
28	69°40'57.778"E	22°47'16.690"N
29	69°41'9.998"E	22°47'44.044"N
30	69°41'10.201"E	22°47'57.091"N
31	69°41'24.376"E	22°47'26.335"N
32	69°42'13.553"E	22°47'8.318"N
33	69°42'26.868"E	22°47'23.693"N
34	69°42'37.345"E	22°47'50.499"N
35	69°42'52.020"E	22°47'38.765"N
36	69°42'51.726"E	22°48'3.075"N
37	69°42'43.597"E	22°48'9.573"N
38	69°42'50.969"E	22°48'21.973"N
39	69°42'14.658"E	22°48'18.784"N
40	69°42'19.806"E	22°48'37.682"N
41	69°42'43.190"E	22°48'52.623"N
42	69°43'26.341"E	22°49'8.778"N
43	69°44'49.105"E	22°49'36.665"N
44	69°45'48.823"E	22°50'8.344"N
45	69°41'17.890"E	22°51'6.694"N
46	69°41'18.675"E	22°51'20.296"N

Lat Long Of Mangrove Area

Sr. No.	Latitude	Longitude
47	69°40'22.704"E	22°46'56.824"N
48	69°41'12.855"E	22°45'49.811"N



DRG NO. HORTI/APSEZL

Implemented Green Zone Development In APSEZL Area
(Mangrove afforestation and Conservation,
Green Zone area & Additional Green Belt Development)

DRG. TITLE:

Landscape Drawing

SCALE :- N.T.S.

DATE : 14.11.2017

adani™

DEPT.OF HORTICULTURE
ADANI PORTS & SPECIAL ECONOMIC ZONE LIMITED,
MUNDRA .

Annexure – 8

adani

Compliance Report of EMP & Mitigation Measures

Sr. No.	Suggested Measures	Compliance Status
✍ **Construction Phase:**		
A	**Air Environment**	
1	Water sprinkling in vulnerable areas	Regular water sprinkling on road and other construction area as well as construction materials.
2	Enforce proper maintenance of vehicles and construction equipment. Allowing only PUC approved vehicles in the site	Please refer Condition No. ix of Part-B (General Conditions: Construction phase) of EC and CRZ Clearance.
3	Enforce usage of covered trucks for transport of such material	Covered trucks are being used for handling of construction materials.
B	**Noise Environment**	
4	Enforce proper maintenance of vehicles and construction equipment. Enforce use of earmuffs / earplugs to workers in high noise level areas	The vehicles of on-going construction work enter inside the premises after the fitness check. Ear protection device is provided to workers in high noise areas.
C	**Water Environment**	
5	Provide temporary drinking water supply and proper sanitation facilities within the site	As a part of dignity of labour adequate provision of drinking water and sanitation facility is being provided. Please refer Condition No. i of Part-B (General Conditions: Construction phase) and xvii of Part-B (General Conditions: Operation phase) of EC and CRZ Clearance.
6	Channelize these waste water to temporary sedimentation tanks for removal of suspended solids	Sewage generated from individual industry is treated by individual industry itself. Some of the industries are giving their sewage to the CETP for treatment and final disposal. Please refer Condition No. i of Part-B iii of Part-B (General Conditions: Operation phase) of EC and CRZ Clearance.
D	**Land / Soil Environment**	
7	Proper disposal of construction debris at regular intervals	Construction debris including bituminous material is being kept at identified temporary storage area and is being utilized for filling / level raising purpose.
E	**Socio-Economic Environment**	
8	It will encourage development of surrounding areas & further generate	Local peoples are preferred for deployment during construction

Sr. No.	Suggested Measures	Compliance Status
	employment. People from various cultures shall mingle encouraging a more tolerant society	activities. Details CSR activity report is attached as **Annexure – 15**.
F	**Thermal Environment**	
9	Enforce (i) use of Portland Pozzalano Cement / (ii) use of Portland Slag Cement / (iii) use fly ash as admixture in construction	Part of fly ash generated from Adani Power Limited, Mundra is being utilized by Adani Group to manufacture paver blocks and the same paver blocks are used for development of back up area, footpath, colonies area, parking area, approach road etc. Please refer Condition No. xi of Part-B (General Conditions: Construction phase) of EC and CRZ Clearance.
G	**Energy**	
10	Wherever possible, piping shall be along the natural topography to permit gravity flow. Else, energy efficient pumps shall be used. Pipe material shall be such as to minimize friction losses.	Few of the buildings in MSTPL are designed as green building. Energy Conservation through Installation of Motion Sensor (Occu switch) & AC Temp. Controls in few of the buildings are provided. Industries are conveyed to meet prescriptive requirements as per Energy Conservation Building Code.
10	Wherever possible, natural light shall be used. Energy efficient electrical fittings and fixtures shall be used.	
✍ **Operation Phase:**		
A	**Land / Soil Environment**	
1	Good quality non-corrosive type pipeline should be used. Regular checking of the pipelines for early detection of any possible leakage and damage. Regular ground water monitoring should be done within the SEZ.	As per the MoUs signed, all existing industries are well connected with impervious pipeline to discharge their effluent / sewage after confirming to the inlet norms of CETP. Third party analysis of the ground water is being carried out at every three month by NABL and MoEF&CC accredited agency namely M/s. Pollucon Laboratories Pvt. Ltd. Please refer Condition No. v of Part-B (General Conditions: Construction phase) of EC and CRZ Clearance.

<table>
<tr><th>Sr. No.</th><th>Suggested Measures</th><th>Compliance Status</th></tr>
<tr><td>2</td><td>The waste should be transported in covered trucks. Vermi-composting is highly recommended for treatment and disposal of biodegradable and kitchen wastes.
Other domestic solid waste (garbage) shall be disposed through MSW facility or as per prevailing norms.</td><td>A well-established system for segregation of dry & wet waste is in place, by which all wet waste (Organic waste) is being segregated & utilized for compost manufacturing; compost is further used by in house horticulture team for green belt development. Whereas Dry Recyclable Waste is being sorted out in various categories & finally being sent for recycling.

The following table summarizes the waste management practice (for Apr'17 to Sep'17) for different types of wastes at Mundra:
<table>
<tr><th>Type of Waste</th><th>Quantity</th><th>Method of Disposal</th></tr>
<tr><td>Dry Waste</td><td>115</td><td>After recovery sent for recycling</td></tr>
<tr><td>Food Waste</td><td>98</td><td>Converted to Manure for Horticulture use</td></tr>
</table>
</td></tr>
<tr><td>3</td><td>The waste should be transported in covered trucks. Transporter should be informed of remedial measures required to be taken in case of spillage of waste</td><td>Waste handling vehicles are being handled through covered trucks only. Photograph showing the same is attached as Annexure – 10.</td></tr>
<tr><td>B</td><td>Socio-Economic Environment</td><td></td></tr>
<tr><td>4</td><td>It will encourage development of surrounding areas & further generate employment. People from various cultures shall mingle encouraging a more tolerant society.</td><td>Adani Foundation (AF) is the CSR arm of the Adani Group actively working for upliftment of the communities in the surroundings of various project sites of Adani Group. AF has prepared a specific action plan to protect livelihood of fishermen at Mundra. APSEZ is actively working with local community (including fishermen community) around the project area and provides required support for their livelihood and other concerns through the CSR arm – Adani Foundation. Brief information about activities in the main five persuasions are mentioned below.

Please refer Condition No. vii of MoEF & CC Order dated 18.09.2015 compliance report.</td></tr>
</table>

Annexure – 9

"HALF YEARLY ENVIRONMENTAL MONITORING REPORT"

FOR

adani™

ADANI PORTS AND SPECIAL ECONOMIC ZONE LIMITED
TAL: MUNDRA, KUTCH, MUNDRA – 370 421

MONITORING PERIOD:
APRIL 2017 TO SEPTEMBER 2017

PREPARED BY:

Pollucon

POLLUCON LABORATORIES PVT.LTD.

**PLOT NO.5/6 "POLLUCON HOUSE", OPP. BALAJI INDUSTRIAL SOCIETY,
OLD SHANTINATH SILK MILL LANE, NEAR GAYTRI FARSAN MART,
NAVJIVAN CIRCLE, UDHANA MAGDALLA ROAD, SURAT-395007.
PHONE/FAX – (+91 261) 2455 751, 2601 106, 2601 224.
E-mail: pollucon@gmail.com web: www.polluconlab.com**

TC - 5945 ISO 9001:2008 ISO 14001:2004 OHSAS 18001:2007

RESULT OF AMBIENT AIR QUALITY MONITORING

ADANI HOUSE								
Sr. No.	Date of Sampling	Particulate Matter (PM10) µg/m³	Particulate Matter (PM 2.5) µg/m³	Sulphur Dioxide (SO2) µg/m³	Oxides of Nitrogen (NO2) µg/m³	Carbon Monoxide as CO mg/m³	Hydrocarbon as CH_4 mg/m³	Benzene as C_6H_6 µg/m³
1	04/04/2017	57.59	22.49	18.97	38.58	0.37	BDL*	BDL*
2	07/04/2017	62.61	28.73	22.04	29.64	0.44	BDL*	BDL*
3	11/04/2017	76.49	36.64	6.33	17.20	0.62	BDL*	BDL*
4	14/04/2017	74.49	41.57	9.60	30.46	0.82	BDL*	BDL*
5	18/04/2017	63.60	34.56	19.40	24.85	0.25	BDL*	BDL*
6	21/04/2017	50.71	20.40	8.79	19.88	0.57	BDL*	BDL*
7	25/04/2017	71.47	38.73	13.07	28.83	0.15	BDL*	BDL*
8	28/04/2017	60.50	30.40	11.62	21.45	0.60	BDL*	BDL*
9	02/05/2017	53.50	28.73	8.73	21.53	0.64	BDL*	BDL*
10	05/05/2017	66.20	26.65	20.91	26.53	0.24	BDL*	BDL*
11	09/05/2017	75.81	33.73	13.80	30.58	0.11	BDL*	BDL*
12	12/05/2017	63.23	30.40	10.95	25.14	0.68	BDL*	BDL*
13	16/05/2017	72.40	31.65	17.52	27.76	0.39	BDL*	BDL*
14	19/05/2017	61.18	24.57	21.50	42.48	0.30	BDL*	BDL*
15	23/05/2017	80.40	41.64	9.59	33.52	0.95	BDL*	BDL*
16	26/05/2017	58.58	29.57	18.64	29.85	0.53	BDL*	BDL*
17	30/05/2017	81.58	37.48	6.17	19.38	0.70	BDL*	BDL*
18	02/06/2017	74.51	37.48	8.89	30.88	1.02	BDL*	BDL*
19	06/06/2017	55.42	27.48	11.82	19.80	0.56	BDL*	BDL*
20	09/06/2017	49.53	19.57	10.51	26.73	0.13	BDL*	BDL*
21	13/06/2017	73.39	34.56	5.61	17.53	0.70	BDL*	BDL*
22	16/06/2017	59.32	22.49	18.45	28.06	0.26	BDL*	BDL*
23	20/06/2017	68.37	36.64	14.97	38.08	0.31	BDL*	BDL*
24	23/06/2017	82.38	30.40	9.63	29.40	0.14	BDL*	BDL*
25	27/06/2017	63.41	26.65	15.13	25.54	0.41	BDL*	BDL*
26	30/06/2017	45.62	29.57	7.16	22.45	0.72	BDL*	BDL*
27	04/07/2017	76.37	37.48	16.63	30.41	0.70	BDL*	BDL*
28	07/07/2017	66.89	32.48	11.95	27.42	1.02	BDL*	BDL*
29	11/07/2017	70.17	26.65	13.46	18.34	0.56	BDL*	BDL*
30	14/07/2017	61.20	28.68	12.72	24.52	0.62	BDL*	BDL*

Continue …

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. ArunBajpai
Lab Manager (Q)

RESULT OF AMBIENT AIR QUALITY MONITORING

ADANI HOUSE								
Sr. No.	Date of Sampling	Particulate Matter (PM10) µg/m³	Particulate Matter (PM 2.5) µg/m³	Sulphur Dioxide (SO2) µg/m³	Oxides of Nitrogen (NO2) µg/m³	Carbon Monoxide as CO mg/m³	Hydrocarbon as CH_4 mg/m³	Benzene as C_6H_6 µg/m³
31	18/07/2017	59.57	23.74	17.59	31.21	0.12	BDL*	BDL*
32	21/07/2017	52.63	20.40	10.63	23.14	0.27	BDL*	BDL*
33	25/07/2017	69.18	33.73	15.89	33.38	0.31	BDL*	BDL*
34	28/07/2017	74.20	39.56	9.90	26.45	0.40	BDL*	BDL*
35	01/08/2017	54.61	30.40	10.19	33.76	0.45	BDL*	BDL*
36	04/08/2017	66.70	38.73	19.55	36.18	0.50	BDL*	BDL*
37	08/08/2017	59.32	33.73	12.83	26.53	0.85	BDL*	BDL*
38	11/08/2017	62.30	29.57	15.94	31.26	0.52	BDL*	BDL*
39	15/08/2017	78.60	37.48	17.48	23.06	0.33	BDL*	BDL*
40	18/08/2017	69.92	28.73	14.86	41.38	0.87	BDL*	BDL*
41	22/08/2017	49.59	19.57	11.44	24.60	0.23	BDL*	BDL*
42	25/08/2017	52.50	24.57	13.42	35.27	0.32	BDL*	BDL*
43	29/08/2017	46.31	21.65	9.71	29.30	0.25	BDL*	BDL*
44	01/09/2017	55.42	21.65	12.32	26.89	0.18	BDL*	BDL*
45	05/09/2017	78.42	40.39	24.31	37.44	0.26	BDL*	BDL*
46	08/09/2017	60.50	27.48	10.63	35.49	0.40	BDL*	BDL*
47	12/09/2017	71.91	38.73	26.14	39.15	0.46	BDL*	BDL*
48	15/09/2017	65.58	30.40	15.84	25.54	0.29	BDL*	BDL*
49	19/09/2017	56.22	25.40	20.59	30.11	0.60	BDL*	BDL*
50	22/09/2017	89.57	42.47	18.94	27.53	0.32	BDL*	BDL*
51	26/09/2017	68.19	37.48	14.90	33.61	0.54	BDL*	BDL*
52	29/09/2017	58.58	24.57	11.33	43.50	0.79	BDL*	BDL*
	TEST METHOD	IS:5182(Part 23):Gravimetric CPCB - Method (Vol.I,May-2011)	Gravimetric-CPCB - Method (Vol.I,May-2011)	IS:5182(Part II):Improved West and Gaeke	IS:5182(Part VI):Modified Jacob & Hochheiser (NaOH-NaAsO2)	NDIR Digital Gas Analyzer	SOP: HC: GC/GCMS/Gas analyzer	IS 5182 (Part XI):2006/CPCB Method

*Below detection limit

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. ArunBajpai
Lab Manager (Q)

RESULTS OF NOISE LEVEL MONITORING

Result of Noise level monitoring [Day Time]

SR. NO.	Name of Location	AIRSTRIP					
		Result [Leq dB(A)]					
	Sampling Date & Time	12/04/2017	17/05/2017	06/02/2017	19/07/2017	23/08/2017	06/09/2017
1	6:00-7:00	52.1	57.1	54.1	52.1	49.5	55.2
2	7:00-8:00	56.4	56.1	58.1	59.7	47.7	60.1
3	8:00-9:00	63.1	60.1	60.4	60.4	58.5	59.4
4	9:00-10:00	62.4	59.8	62.4	55.1	53.4	63.1
5	10:00-11:00	68.4	59.1	68.4	63.8	59.1	54.1
6	11:00-12:00	61.4	62.4	59.4	65.8	62.4	63.1
7	12:00-13:00	60.4	63.1	60.4	65.4	63.1	60.4
8	13:00-14:00	58.4	66.4	62.1	63.9	57.3	60.9
9	14:00-15:00	60.4	64.1	58.7	68.2	52.1	63.2
10	15:00-16:00	60.9	62.7	56.1	62.9	56.4	62.8
11	16:00-17:00	63.1	62.8	58.4	60.8	64.8	65.1
12	17:00-18:00	61.4	60.4	60.4	59.7	58.8	60.8
13	18:00-19:00	65.4	65.1	55.8	62.7	60.0	60.6
14	19:00-20:00	62.4	62.7	59.8	62.8	58.4	57.2
15	20:00-21:00	60.4	60.8	56.4	60.8	65.2	59.1
16	21:00-22:00	60.7	63.4	58.4	60.4	63.3	62.4
Day Time Limit*		75 Leq dB(A)					

Result of Noise level monitoring [Night Time]

SR. NO.	Name of Location	AIRSTRIP					
		Result [Leq dB(A)]					
1	Sampling Date & Time	12/04/2017 & 13/04/2017	17/05/2017 & 18/05/2017	02/06/2017 & 03/06/2017	19/07/2017 & 20/08/2017	23/08/2017 & 24/08/2017	06/09/2017 & 07/09/2017
2	22:00-23:00	62.4	58.1	59.4	55.7	55	56.1
3	23:00-00:00	60.1	55.1	51.4	59.4	51.4	47.1
4	00:00-01:00	55.4	50.4	50.4	56.1	50.6	52.1
5	01:00-02:00	59.7	53.1	58.7	60.8	49.8	51.8
6	02:00-03:00	56.1	57.1	56.4	62.8	57.6	58.4
7	03:00-04:00	52.4	60.4	52.4	57.1	54.9	53.1
8	04:00-05:00	53.7	56.1	60.4	53.8	49.0	52.8
9	05:00-06:00	59.7	62.8	58.7	59.7	53.4	56.8
Night Time Limit*		70 Leq dB(A)					

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. ArunBajpai
Lab Manager (Q)

RESULT OF CETP OUTLET

SR. NO.	TEST PARAMETERS	UNIT	CETP OUTLET						GPCB Permissible Limit CETP OUTLET	TEST METHOD
			April-17	May-17	June-17	July-17	Aug-17	Sept-17		
1	pH	--	8.49	7.11	7.41	7.57	7.73	6.89	6 to 9	IS3025(P11)83Re.02
2	Temperature	°C	30	29	28	28	30	29	Shall Not exceed more than 5 °C above ambient water temperature	IS3025(P9)84Re.02
3	Colour	Co-pt	40	30	40	20	70	30	100	IS3025(P4)83Re.02
4	Total Suspended Solids	mg/L	88	32	30	16	18	18	100	IS3025(P17)84Re.02
5	Oil & Grease	mg/L	1.02	BDL*	BDL*	BDL*	BDL*	BDL*	10	APHA(22ndEdi)5520D
6	Phenolic Compound	mg/L	BDL*	BDL*	BDL*	BDL*	BDL*	BDL*	1	IS3025(P43)92Re.03
7	Fluorides	mg/L	0.64	0.76	0.64	0.71	BDL*	BDL*	2	APHA(22nd Edi) 4500 F D SPANDS
8	Iron	mg/L	--	--	--	0.76	0.031	0.027	3	AAS APHA(22ndEdi)3111 B
9	Zinc as Zn	mg/L	--	--	--	1.08	0.037	0.042	15	AAS APHA(22ndEdi)3111 B
10	Trivalent Chromium	mg/L	--	--	--	0.13	0.09	0.08	2	AAS APHA(22ndEdi)3111 B
11	Sulphide as S	mg/L	0.92	1.74	0.98	1.36	0.72	BDL*	2	APHA(22ndEdi) 4500-S
12	Ammonical Nitrogen as NH_3	mg/L	2.55	8.18	1.22	1.48	15.88	16.96	50	IS3025(P34)88Cla.2.3
13	BOD (3 Days @ 27 °C)	mg/L	28	14	32	18	20	22	100	IS 3025 (P44)1993Re.03Edition2 .1
14	COD	mg/L	92	66	110	57	64	75	250	APHA(22ndEdi) 5520-D Open Reflux
15	Chloride as Cl	mg/L	402	545	467	539	639	614	1000	IS3025(P32)88Re.99
16	Sulphate as SO_4	mg/L	98	108	78	114	146	236	1000	APHA(22ndEdi)4500 SO_4 E
17	Total Dissolved Solids	mg/L	1452	1155	1239	1112	1328	1076	2100	IS3025(P16)84Re.02
18	Total Residual Chlorine	mg/L	0.5	0.5	0.6	0.8	0.7	0.6	1	APHA(22ndEdi)4500 Cl
19	Copper as Cu	mg/L	0.21	0.021	0.027	0.03	0.031	0.018	3	AAS APHA(22ndEdi)3111 B

*Below Detection Limit

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

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RESULT OF AMBIENT AIR QUALITY MONITORING

WTP- NEAR CETP						
Sr.No.	**Date of Sampling**	**Particulate Matter (PM_{10}) µg/m3**	**Particulate Matter ($PM_{2.5}$) µg/m3**	**Sulphur Dioxide (SO_2) µg/m3**	**Oxides of Nitrogen (NO_2) µg/m3**	**Hydrogen sulphide(H_2S) µg/m3**
1	01/04/2017	87.80	39.52	19.40	42.56	BDL*
2	05/04/2017	95.48	56.58	22.94	37.21	BDL*
3	08/04/2017	80.49	37.44	15.82	40.24	BDL*
4	12/04/2017	76.77	43.68	18.52	31.61	BDL*
5	15/04/2017	86.52	52.45	21.98	38.61	BDL*
6	19/04/2017	82.50	46.60	14.88	44.59	BDL*
7	22/04/2017	97.49	42.44	24.53	33.49	BDL*
8	26/04/2017	86.52	54.50	17.58	30.70	BDL*
9	29/04/2017	90.60	38.69	26.20	39.56	BDL*
10	05/03/2017	65.07	28.71	22.56	35.63	BDL*
11	05/06/2017	81.22	37.44	18.22	33.74	BDL*
12	05/10/2017	70.62	43.68	14.84	34.79	BDL*
13	13/05/2017	87.50	40.36	17.35	28.08	BDL*
14	17/05/2017	75.80	33.70	12.45	36.56	BDL*
15	20/05/2017	82.68	45.76	13.36	23.52	BDL*
16	24/05/2017	92.62	54.50	21.83	31.85	BDL*
17	27/05/2017	62.88	34.53	15.77	39.19	BDL*
18	31/05/2017	78.60	39.52	19.28	29.76	BDL*
19	06/03/2017	89.33	46.60	19.46	36.36	BDL*
20	06/07/2017	75.80	40.36	15.97	43.49	BDL*
21	06/10/2017	60.81	26.63	11.38	28.66	BDL*
22	14/06/2017	82.32	43.68	22.99	32.30	BDL*
23	17/06/2017	71.47	36.61	18.19	25.19	BDL*
24	21/06/2017	92.37	51.59	14.20	35.89	BDL*
25	24/06/2017	78.30	33.70	20.49	45.63	BDL*
26	28/06/2017	68.61	41.60	23.80	38.29	BDL*
27	05/07/2017	85.79	52.42	18.54	28.22	BDL*
28	08/07/2017	91.21	47.43	22.80	30.48	BDL*
29	12/07/2017	80.61	40.36	14.35	26.34	BDL*
30	19/07/2017	71.47	30.34	17.42	34.57	BDL*

Continue …

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

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WTP- NEAR CETP						
Sr.No.	**Date of Sampling**	**Particulate Matter (PM10) µg/m3**	**Particulate Matter (PM2.5) µg/m3**	**Sulphur Dioxide (SO2) µg/m3**	**Oxides of Nitrogen (NO2) µg/m3**	**Hydrogen sulphide(H2S) µg/m3**
31	22/07/2017	71.23	27.46	19.19	33.16	BDL*
32	26/07/2017	88.41	42.44	25.42	42.33	BDL*
33	29/07/2017	58.37	25.38	17.54	25.63	BDL*
34	02/08/2017	84.21	41.60	18.40	30.40	BDL*
35	05/08/2017	77.81	46.60	24.47	36.70	BDL*
36	09/08/2017	80.31	49.51	21.38	42.78	BDL*
37	12/08/2017	67.33	27.46	19.20	32.57	BDL*
38	16/08/2017	90.42	54.50	25.34	35.61	BDL*
39	19/08/2017	86.22	38.69	13.20	39.30	BDL*
40	23/08/2017	94.32	42.44	17.48	45.60	BDL*
41	26/08/2017	75.19	29.54	15.20	25.57	BDL*
42	30/08/2017	57.58	21.63	16.74	40.29	BDL*
43	02/09/2017	61.17	35.36	21.33	32.06	BDL*
44	06/09/2017	77.50	42.44	28.07	40.41	BDL*
45	09/09/2017	82.38	50.34	25.35	37.44	BDL*
46	13/09/2017	92.37	48.68	20.24	45.43	BDL*
47	16/09/2017	54.78	23.71	11.56	25.10	BDL*
48	20/09/2017	66.78	39.52	19.87	43.68	BDL*
49	23/09/2017	80.49	44.52	22.81	35.39	BDL*
50	27/09/2017	69.28	27.46	15.84	39.38	BDL*
51	30/09/2017	84.57	31.62	17.49	34.19	BDL*
TEST METHOD		**IS:5182(Part 23):Gravimetric CPCB - Method (Vol.I,May-2011)**	**Gravimetric-CPCB - Method (Vol.I,May-2011)**	**IS:5182(Part II):Improved West and Gaeke**	**IS:5182(Part VI):Modified Jacob & Hochheiser (NaOH-NaAsO2)**	**IS:5182(Part VII) 1973**

*Below detection limit

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

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RESULTS OF NOISE LEVEL MONITORING

Result of Noise level monitoring [Day Time]

SR. NO.	Name of Location	CETP					
		Result [dB(A) Leq]					
	Sampling Date & Time	03/04/2017	05/03/2017	06/07/2017	05/07/2017	05/08/2017	20/09/2017
1	6:00-7:00	63.4	62.1	63.4	62.7	58.4	68.4
2	7:00-8:00	61.4	68.7	60.4	69.1	52.7	62.1
3	8:00-9:00	61.8	66.1	61.8	65.7	69.4	69.7
4	9:00-10:00	65.1	66.3	68.4	70.4	62.4	63.1
5	10:00-11:00	72.4	64.7	62.4	72.1	70.1	70.1
6	11:00-12:00	69.4	69.1	65.1	68.1	65.4	72.3
7	12:00-13:00	68.1	70.5	65.3	63.5	64.7	63.1
8	13:00-14:00	69.4	71.7	69.4	65.9	61.05	69.4
9	14:00-15:00	66.1	68.1	73.1	69.1	67.3	64.1
10	15:00-16:00	63.4	68.2	68.4	62.8	65.4	62.8
11	16:00-17:00	66.7	65.2	65.1	66.1	62.4	68.1
12	17:00-18:00	64.1	65.1	65.9	62.8	67.9	71.3
13	18:00-19:00	62.5	65.8	62.4	66.1	61.7	68.1
14	19:00-20:00	63.8	63.1	66.1	69.4	60.8	65.1
15	20:00-21:00	68.1	61.8	66.8	65.6	67.1	65.9
16	21:00-22:00	62.4	60.4	64.1	63.7	68.2	64.2
Day Time Limit*		75 dB(A) Leq					

Result of Noise level monitoring [Night Time]

SR. NO.	Name of Location	CETP					
		Result [dB(A) Leq]					
	Sampling Date & Time	03/04/2017 & 04/04/2017	03/05/2017 & 04/05/2017	07/06/2017 & 08/06/2017	05/07/2017 & 06/07/2017	05/08/2017 & 06/08/2017	20/09/2017 & 21/08/2017
1	22:00-23:00	62.1	68.5	62.1	60.4	61.9	55.1
2	23:00-00:00	60.4	66.2	58.4	62.8	58.7	61.8
3	00:00-01:00	63.4	65.3	63.4	59.4	57.1	56.7
4	01:00-02:00	65.1	66.7	67.0	62.7	61.4	59.7
5	02:00-03:00	59.4	61.4	66.1	61.8	63.4	62.1
6	03:00-04:00	61.4	64.4	62.4	60.9	58.8	65.4
7	04:00-05:00	62.7	60.4	61.4	60.4	54.3	60.4
8	05:00-06:00	63.4	63.4	60.4	62.8	53.1	57.4
Night Time Limit*		70 dB(A) Leq					

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF STP WATER OUTLET

SR. NO	TEST PARAMETERS	Unit	AMSIPL SAMUNDRA TOWNSHIP STP OUTLET						GPCB Permissible Limit	TEST METHOD
			April-17		May-17		June-17			
			5/4/17	17/4/17	5/3/17	17/5/17	6/6/17	19/6/17		
1	pH	--	7.09	6.63	6.94	7.49	6.56	7.46	--	IS3025(P11)83Re.02
2	Total Suspended Solids	mg/ L	24	26	28	13	26	28	**30**	IS3025(P17)84Re.02
3	BOD (3 days @ 270 C)	mg/ L	18	17	19	16	12	14	**20**	IS 3025 (P44)1993Re.03Edition2.1
4	Residual Chlorine	mg/ L	0.8	0.5	0.5	0.6	0.7	0.6	**Min 0.5**	APHA(22nd Edi)4500 Cl

SR. NO	TEST PARAMETERS	Unit	AMSIPL SAMUNDRA TOWNSHIP STP OUTLET						GPCB Permissible Limit	TEST METHOD
			July-17		Aug-17		Sept-17			
			5/7/17	19/7/17	3/8/17	23/8/17	4/9/17	20/9/17		
1	pH	--	7.61	7.5	7.39	6.88	7.33	6.9	--	IS3025(P11)83Re.02
2	Total Suspended Solids	mg/L	16	22	16	14	22	26	**30**	IS3025(P17)84Re.02
3	BOD (3 days @ 270 C)	mg/L	10	10	8	6	10	17	**20**	IS 3025 (P44)1993Re.03Edition2.1
4	Residual Chlorine	mg/L	0.5	0.5	0.7	<0.8	0.7	0.7	**Min 0.5**	APHA(22nd Edi)4500 Cl

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

SR. NO	TEST PARAMETERS	Unit	ADANI HOSPITAL STP OUTLET						GPCB Permissible Limit	TEST METHOD
			April-17		May-17		June-17			
			5/4/17	17/4/17	5/3/17	17/5/17	6/6/17	19/6/17		
1	pH	--	7.28	7.22	7.13	7.31	7.02	7.4	--	IS3025(P11)83Re.02
2	Total Suspended Solids	mg/L	26	24	22	29	22	26	30	IS3025(P17)84Re.02
3	BOD (3 days @ 270 C)	mg/L	14	14	15	14	18	16	20	IS 3025 (P44)1993Re.03Edition2.1
4	Residual Chlorine	mg/L	0.5	0.7	0.8	0.9	0.6	0.5	Min 0.5	APHA(22nd Edi)4500 Cl

*Below Detection limit

SR. NO	TEST PARAMETERS	Unit	ADANI HOSPITAL STP OUTLET						GPCB Permissible Limit	TEST METHOD
			July-17		Aug-17		Sept-17			
			5/7/17	19/7/17	4/8/17	23/8/17	4/9/17	20/9/17		
1	pH	--	7.51	7.35	7.49	7.37	7.11	7.34	--	IS3025(P11)83Re.02
2	Total Suspended Solids	mg/L	22	24	24	22	22	20	30	IS3025(P17)84Re.02
3	BOD (3 days @ 270 C)	mg/L	16	14	19	16	17	19	20	IS 3025 (P44)1993Re.03Edition2.1
4	Residual Chlorine	mg/L	0.8	0.8	0.5	0.6	0.7	0.8	Min 0.5	APHA(22nd Edi)4500 Cl

*Below Detection limit

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF AMBIENT AIR QUALITY MONITORING

SAMUDRA TOWNSHIP STP					
Sr. No.	**Date of Sampling**	**Particulate Matter (PM_{10}) µg/m3**	**Particulate Matter ($PM_{2.5}$) µg/m3**	**Sulphur Dioxide (SO_2) µg/m3**	**Oxides of Nitrogen (NO_2) µg/m3**
1	01/04/2017	66.91	29.52	10.23	31.37
2	05/04/2017	92.59	50.72	25.28	44.28
3	08/04/2017	75.52	32.43	21.79	27.61
4	12/04/2017	49.59	18.71	15.74	34.60
5	15/04/2017	57.58	30.80	17.32	33.67
6	19/04/2017	71.31	40.74	6.26	18.22
7	22/04/2017	56.30	20.37	8.63	22.83
8	26/04/2017	76.19	39.50	12.20	19.37
9	29/04/2017	61.30	28.69	20.12	26.36
10	05/03/2017	53.68	24.53	13.21	31.38
11	05/06/2017	69.29	32.43	16.51	28.89
12	05/10/2017	58.37	26.61	8.60	24.11
13	13/05/2017	72.59	34.51	19.36	34.08
14	17/05/2017	63.32	27.44	17.15	21.41
15	20/05/2017	49.77	21.62	6.88	19.63
16	24/05/2017	56.48	31.60	7.79	36.95
17	27/05/2017	42.52	15.38	11.15	26.81
18	31/05/2017	70.51	28.69	5.18	21.01
19	06/03/2017	78.50	38.66	14.25	42.89
20	06/07/2017	56.79	30.35	7.87	26.73
21	06/10/2017	43.49	18.71	9.44	21.63
22	14/06/2017	58.19	32.43	15.79	35.35
23	17/06/2017	48.19	21.62	12.32	23.54
24	21/06/2017	74.17	40.74	10.94	31.60
25	24/06/2017	52.40	19.54	17.42	27.57
26	28/06/2017	63.38	39.50	20.46	34.41
27	05/07/2017	78.63	44.49	21.74	33.37
28	08/07/2017	82.59	54.46	19.70	20.15
29	12/07/2017	62.71	32.43	10.17	30.22
30	19/07/2017	46.36	19.68	14.88	30.43

Continue..

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

SAMUDRA TOWNSHIP STP					
Sr. No.	**Date of Sampling**	**Particulate Matter (PM_{10}) µg/m3**	**Particulate Matter ($PM_{2.5}$) µg/m3**	**Sulphur Dioxide (SO_2) µg/m3**	**Oxides of Nitrogen (NO_2) µg/m3**
31	22/07/2017	46.79	24.53	13.35	36.31
32	26/07/2017	63.38	30.35	16.52	38.71
33	29/07/2017	40.32	17.46	7.83	19.59
34	02/08/2017	73.62	39.50	20.27	36.61
35	05/08/2017	83.38	53.63	12.26	19.59
36	09/08/2017	61.18	36.59	18.18	38.76
37	12/08/2017	56.30	23.70	16.44	23.69
38	16/08/2017	76.49	44.49	14.14	30.58
39	19/08/2017	68.50	30.35	17.22	22.39
40	23/08/2017	82.71	38.66	21.96	40.48
41	26/08/2017	65.33	26.61	8.67	21.53
42	30/08/2017	40.62	15.38	11.11	27.51
43	02/09/2017	52.58	31.60	8.64	25.39
44	06/09/2017	65.57	29.52	18.19	30.35
45	09/09/2017	76.49	42.41	21.21	19.42
46	13/09/2017	57.58	32.43	15.87	36.51
47	16/09/2017	38.61	15.38	5.24	22.41
48	20/09/2017	56.30	36.59	10.58	32.48
49	23/09/2017	73.62	39.50	26.45	42.68
50	27/09/2017	61.42	24.53	22.69	27.53
51	30/09/2017	54.47	20.37	12.65	24.18
	TEST METHOD	**IS:5182(Part 23):Gravimetric CPCB - Method (Vol.I,May-2011)**	**Gravimetric- CPCB - Method (Vol.I,May-2011)**	**IS:5182(Part II):Improved West and Gaeke**	**IS:5182(Part VI):Modified Jacob & Hochheiser (NaOH-NaAsO2)**

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF AMBIENT AIR QUALITY MONITORING

SAMUDRA TOWNSHIP CUSTOMER CARE					
Sr.No.	**Date of Sampling**	**Particulate Matter (PM_{10}) µg/m3**	**Particulate Matter ($PM_{2.5}$) µg/m3**	**Sulphur Dioxide (SO_2) µg/m3**	**Oxides of Nitrogen (NO_2) µg/m3**
1	01/04/2017	92.80	42.47	16.38	26.40
2	05/04/2017	81.60	47.47	18.72	33.35
3	08/04/2017	65.48	29.56	7.80	30.43
4	12/04/2017	70.53	33.73	11.74	25.22
5	15/04/2017	51.57	26.46	14.18	31.50
6	19/04/2017	89.31	52.46	19.19	22.30
7	22/04/2017	77.51	35.39	17.56	35.64
8	26/04/2017	83.59	45.38	9.39	23.39
9	29/04/2017	72.52	32.48	12.52	37.52
10	05/03/2017	46.76	20.40	16.52	27.75
11	05/06/2017	57.17	25.40	13.35	24.83
12	05/10/2017	77.21	33.73	11.19	19.94
13	13/05/2017	65.29	29.56	9.42	25.67
14	17/05/2017	56.33	24.57	5.20	30.05
15	20/05/2017	61.50	34.56	10.40	26.50
16	24/05/2017	86.48	48.72	14.92	26.08
17	27/05/2017	55.61	28.73	8.64	20.03
18	31/05/2017	63.49	35.39	12.22	32.34
19	06/03/2017	71.19	34.56	11.77	32.37
20	06/07/2017	62.83	38.72	13.95	36.21
21	06/10/2017	52.60	21.65	5.51	25.56
22	14/06/2017	74.62	35.39	17.55	19.59
23	17/06/2017	65.78	30.40	14.27	33.13
24	21/06/2017	79.32	43.72	7.95	22.15
25	24/06/2017	60.18	23.73	12.33	30.45
26	28/06/2017	45.32	29.56	18.17	29.39
27	05/07/2017	70.71	39.56	11.50	23.39
28	08/07/2017	56.33	33.73	16.64	26.34
29	12/07/2017	69.33	37.47	8.76	17.09
30	19/07/2017	40.20	15.62	10.28	27.40

Continue..

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

SAMUDRA TOWNSHIP CUSTOMER CARE					
Sr.No.	**Date of Sampling**	**Particulate Matter (PM_{10}) µg/m3**	**Particulate Matter ($PM_{2.5}$) µg/m3**	**Sulphur Dioxide (SO_2) µg/m3**	**Oxides of Nitrogen (NO_2) µg/m3**
31	22/07/2017	62.41	20.40	10.48	28.33
32	26/07/2017	51.51	24.57	14.93	30.77
33	29/07/2017	46.28	19.57	12.22	29.50
34	02/08/2017	65.17	36.64	10.48	27.24
35	05/08/2017	70.59	42.47	14.20	29.40
36	09/08/2017	59.22	26.65	12.74	32.43
37	12/08/2017	49.41	20.40	8.73	26.38
38	16/08/2017	67.52	38.72	17.53	28.59
39	19/08/2017	56.69	35.39	15.88	31.57
40	23/08/2017	75.28	33.73	11.39	37.48
41	26/08/2017	58.61	23.73	13.23	18.38
42	30/08/2017	52.72	19.57	9.67	21.40
43	02/09/2017	45.62	15.41	17.30	30.23
44	06/09/2017	55.12	25.40	21.23	36.66
45	09/09/2017	62.29	38.72	18.32	27.43
46	13/09/2017	76.79	42.47	11.36	33.42
47	16/09/2017	43.57	18.74	7.91	29.52
48	20/09/2017	72.58	46.63	16.65	24.64
49	23/09/2017	67.22	30.40	14.29	31.42
50	27/09/2017	53.38	21.65	13.36	35.00
51	30/09/2017	66.38	26.65	8.68	28.57
	TEST METHOD	**IS:5182(Part 23):Gravimetric CPCB - Method (Vol.I,May-2011)**	**Gravimetric- CPCB - Method (Vol.I,May-2011)**	**IS:5182(Part II):Improved West and Gaeke**	**IS:5182(Part VI):Modified Jacob & Hochheiser (NaOH-NaAsO2)**

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF AMBIENT AIR QUALITY MONITORING

PUB/ADANI HOUSE								
Sr. No.	Date of Sampling	Particulate Matter (PM10) µg/m³	Particulate Matter (PM 2.5) µg/m³	Sulphur Dioxide (SO2) µg/m³	Oxides of Nitrogen (NO2) µg/m³	Carbon Monoxide as CO mg/m³	Hydrocarbon as CH_4 mg/m³	Benzene as C_6H_6 µg/m³
1	04/04/2017	57.59	22.49	18.97	38.58	0.37	BDL*	BDL*
2	07/04/2017	62.61	28.73	22.04	29.64	0.44	BDL*	BDL*
3	11/04/2017	76.49	36.64	6.33	17.20	0.62	BDL*	BDL*
4	14/04/2017	74.49	41.57	9.60	30.46	0.82	BDL*	BDL*
5	18/04/2017	63.60	34.56	19.40	24.85	0.25	BDL*	BDL*
6	21/04/2017	50.71	20.40	8.79	19.88	0.57	BDL*	BDL*
7	25/04/2017	71.47	38.73	13.07	28.83	0.15	BDL*	BDL*
8	28/04/2017	60.50	30.40	11.62	21.45	0.60	BDL*	BDL*
9	02/05/2017	53.50	28.73	8.73	21.53	0.64	BDL*	BDL*
10	05/05/2017	66.20	26.65	20.91	26.53	0.24	BDL*	BDL*
11	09/05/2017	75.81	33.73	13.80	30.58	0.11	BDL*	BDL*
12	12/05/2017	63.23	30.40	10.95	25.14	0.68	BDL*	BDL*
13	16/05/2017	72.40	31.65	17.52	27.76	0.39	BDL*	BDL*
14	19/05/2017	61.18	24.57	21.50	42.48	0.30	BDL*	BDL*
15	23/05/2017	80.40	41.64	9.59	33.52	0.95	BDL*	BDL*
16	26/05/2017	58.58	29.57	18.64	29.85	0.53	BDL*	BDL*
17	30/05/2017	81.58	37.48	6.17	19.38	0.70	BDL*	BDL*
18	02/06/2017	74.51	37.48	8.89	30.88	1.02	BDL*	BDL*
19	06/06/2017	55.42	27.48	11.82	19.80	0.56	BDL*	BDL*
20	09/06/2017	49.53	19.57	10.51	26.73	0.13	BDL*	BDL*
21	13/06/2017	73.39	34.56	5.61	17.53	0.70	BDL*	BDL*
22	16/06/2017	59.32	22.49	18.45	28.06	0.26	BDL*	BDL*
23	20/06/2017	68.37	36.64	14.97	38.08	0.31	BDL*	BDL*
24	23/06/2017	82.38	30.40	9.63	29.40	0.14	BDL*	BDL*
25	27/06/2017	63.41	26.65	15.13	25.54	0.41	BDL*	BDL*
26	30/06/2017	45.62	29.57	7.16	22.45	0.72	BDL*	BDL*
27	04/07/2017	76.37	37.48	16.63	30.41	0.70	BDL*	BDL*
28	07/07/2017	66.89	32.48	11.95	27.42	1.02	BDL*	BDL*
29	11/07/2017	70.17	26.65	13.46	18.34	0.56	BDL*	BDL*
30	14/07/2017	61.20	28.68	12.72	24.52	0.62	BDL*	BDL*

Continue...

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

PUB/ADANI HOUSE								
Sr. No.	**Date of Sampling**	**Particulate Matter (PM10) µg/m³**	**Particulate Matter (PM 2.5) µg/m³**	**Sulphur Dioxide (SO2) µg/m³**	**Oxides of Nitrogen (NO2) µg/m³**	**Carbon Monoxide as CO mg/m³**	**Hydrocarbon as CH_4 mg/m³**	**Benzene as C_6H_6 µg/m³**
31	18/07/2017	59.57	23.74	17.59	31.21	0.12	BDL*	BDL*
32	21/07/2017	52.63	20.40	10.63	23.14	0.27	BDL*	BDL*
33	25/07/2017	69.18	33.73	15.89	33.38	0.31	BDL*	BDL*
34	28/07/2017	74.20	39.56	9.90	26.45	0.40	BDL*	BDL*
35	01/08/2017	54.61	30.40	10.19	33.76	0.45	BDL*	BDL*
36	04/08/2017	66.70	38.73	19.55	36.18	0.50	BDL*	BDL*
37	08/08/2017	59.32	33.73	12.83	26.53	0.85	BDL*	BDL*
38	11/08/2017	62.30	29.57	15.94	31.26	0.52	BDL*	BDL*
39	15/08/2017	78.60	37.48	17.48	23.06	0.33	BDL*	BDL*
40	18/08/2017	69.92	28.73	14.86	41.38	0.87	BDL*	BDL*
41	22/08/2017	49.59	19.57	11.44	24.60	0.23	BDL*	BDL*
42	25/08/2017	52.50	24.57	13.42	35.27	0.32	BDL*	BDL*
43	29/08/2017	46.31	21.65	9.71	29.30	0.25	BDL*	BDL*
44	01/09/2017	55.42	21.65	12.32	26.89	0.18	BDL*	BDL*
45	05/09/2017	78.42	40.39	24.31	37.44	0.26	BDL*	BDL*
46	08/09/2017	60.50	27.48	10.63	35.49	0.40	BDL*	BDL*
47	12/09/2017	71.91	38.73	26.14	39.15	0.46	BDL*	BDL*
48	15/09/2017	65.58	30.40	15.84	25.54	0.29	BDL*	BDL*
49	19/09/2017	56.22	25.40	20.59	30.11	0.60	BDL*	BDL*
50	22/09/2017	89.57	42.47	18.94	27.53	0.32	BDL*	BDL*
51	26/09/2017	68.19	37.48	14.90	33.61	0.54	BDL*	BDL*
52	29/09/2017	58.58	24.57	11.33	43.50	0.79	BDL*	BDL*
	TEST METHOD	**IS:5182(Part 23):Gravimetric CPCB - Method (Vol.I,May-2011)**	**Gravimetric-CPCB - Method (Vol.I,May-2011)**	**IS:5182(Part II):Improved West and Gaeke**	**IS:5182(Part VI):Modified Jacob & Hochheiser (NaOH-NaAsO2)**	**NDIR Digital Gas Analyzer**	**SOP: HC: GC/GCMS/Gas analyzer**	**IS 5182 (Part XI):2006/CPCB Method**

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULT NOISE LEVEL MONITORING

Result of Noise level monitoring [Day Time]

SR. NO.	Name of Location	SAMUNDRA TOWNSHIP STP					
		Result [Leq dB(A)]					
	Sampling Date & Time	19/04/2017	24/05/2017	21/06/2017	26/07/2017	09/08/2017	13/09/2017
1	6:00-7:00	58.4	59.2	62.4	61.7	62.3	63.1
2	7:00-8:00	58.1	63.1	66.1	55.4	58.8	68.4
3	8:00-9:00	62.4	62.8	62.4	59.1	52.1	62.1
4	9:00-10:00	60.4	66.2	59.4	61.7	60	68.1
5	10:00-11:00	68.4	68.1	60.4	65.8	59.7	65.2
6	11:00-12:00	65.7	72.1	60.7	65.1	67.4	59.1
7	12:00-13:00	67.1	70.1	63.4	59.1	62.9	56.1
8	13:00-14:00	62.6	65.1	61.8	62.7	61.4	63.1
9	14:00-15:00	63.4	68.2	65.1	67.4	62.7	61.4
10	15:00-16:00	64.1	62.4	61.4	62.4	64.8	65.2
11	16:00-17:00	68.7	63.4	61.8	61.8	62	68.7
12	17:00-18:00	62.4	65.8	62.7	60.9	67.4	66.2
13	18:00-19:00	68.4	68.1	64.8	63.8	65.8	68.4
14	19:00-20:00	69.4	62.4	59.7	62.8	61.9	64.3
15	20:00-21:00	67.2	64.8	62.4	65.1	59.8	69.8
16	21:00-22:00	62.4	65.6	60.1	61.8	58.1	67.2
Day Time Limit*		75 Leq dB(A)					

Result of Noise level monitoring [Night Time]

SR. NO.	Name of Location	SAMUNDRA TOWNSHIP STP					
		Result [Leq dB(A)]					
	Sampling Date & Time	19/04/2017 & 20/04/2017	24/05/2017 & 24/05/2017	21/06/2017 & 22/06/2017	26/07/2017 & 27/07/2017	09/08/2017 & 10/08/2017	13/09/2017 & 14/08/2017
1	22:00-23:00	60.4	61.4	59.4	65.1	64	61.4
2	23:00-00:00	61.5	58.4	62.4	58.7	57.2	60.8
3	00:00-01:00	59.8	55.1	61.4	53.7	51.6	65.1
4	01:00-02:00	62.1	5.2	60.4	52.9	50.9	62.9
5	02:00-03:00	60.4	57.1	60.7	52.1	58.8	59.9
6	03:00-04:00	60.8	62.4	61.8	56.4	52.4	60.4
7	04:00-05:00	61.7	61.4	59.7	55.9	60	58.1
8	05:00-06:00	62.5	59.8	62.1	58.4	51.6	62.4
Night Time Limit*		70 Leq dB(A)					

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

Result of Noise level monitoring [Day Time]

SR. NO.	Name of Location	SAMUNDRA TOWNSHIP CUSTOMER CARE					
		Result [Leq dB(A)]					
	Sampling Date & Time	05/04/2017	05/10/2017	28/06/2017	12/07/2017	16/08/2017	27/09/2017
1	6:00-7:00	54.1	58.1	55.1	54.1	52.4	57.1
2	7:00-8:00	59.4	62.1	60.4	59.1	60.4	60.5
3	8:00-9:00	55.1	65.1	62.1	62.4	61.9	63.1
4	9:00-10:00	63.4	60.1	65.4	63.1	58.7	65.1
5	10:00-11:00	68.4	59.4	61.7	69.1	68.4	60.4
6	11:00-12:00	62.4	62.8	65.4	65.1	64.5	69.4
7	12:00-13:00	61.4	65.4	68.4	62.4	65.1	62.4
8	13:00-14:00	68.4	63.1	61.7	60.4	68.7	65.3
9	14:00-15:00	62.1	68.4	65.1	59.7	68.98	69.4
10	15:00-16:00	64.1	62.1	66.1	57.1	62.4	62.4
11	16:00-17:00	63.7	65.1	68.4	60.4	61.4	60.8
12	17:00-18:00	68.4	61.4	63.4	60.9	63.84	59.1
13	18:00-19:00	66.1	68.7	61.8	63.1	59.1	57.2
14	19:00-20:00	66.4	66.7	60.4	66.7	62.7	62.1
15	20:00-21:00	69.4	60.1	62.7	69.1	64.8	65.4
16	21:00-22:00	67.2	59.8	61.8	65.5	61.9	63.1
Day Time Limit*		75 Leq dB(A)					

Result of Noise level monitoring [Night Time]

SR. NO.	Name of Location	SAMUNDRA TOWNSHIP CUSTOMER CARE					
		Result [Leq dB(A)]					
	Sampling Date & Time	05/04/2017 & 06/04/2017	10/05/2017 & 11/05/2017	28/06/2017 & 29/06/2017	12/07/2017 & 13/07/2017	16/08/2017 & 17/08/2017	27/09/2017 & 28/09/2017
1	22:00-23:00	68.4	62.1	62.4	62.8	60.4	60.4
2	23:00-00:00	65.1	57.1	65.4	65.7	58.8	52.1
3	00:00-01:00	58.1	54.1	59.7	55.4	59.4	57.1
4	01:00-02:00	53.4	51.4	57.4	59.8	54.1	53.4
5	02:00-03:00	62.1	56.1	52.4	56.8	58.5	60.4
6	03:00-04:00	60.4	52.4	56.4	55.4	60.4	62.4
7	04:00-05:00	61.4	58.1	58.4	53.4	54.1	61.4
8	05:00-06:00	60.8	55.1	60.4	68.4	63.7	67.4
Night Time Limit*		70 Leq dB(A)					

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF BORE HOLE WATER

SR. NO	TEST PARAMETERS	UNIT	RESULTS		TEST METHOD
			NEAR CETP MAIN GATE		
	GPS Location		N 22° 48.630' S 069° 42.393'		
	Sampling Date		17/04/2017	19/07/2017	
	Sampling Time		12:40	11:30	
1	pH	--	7.93	7.98	IS3025(P11)83Re.02
2	Salinity	mg/L	4.06	4.59	APHA 2520B
3	Oil & Grease	mg/L	BDL*	1.68	APHA(22nd Edi)5520D
4	Hydrocarbon	mg/L	BDL*	BDL*	GC/GC-MS
5	Lead as Pb	mg/L	BDL*	0.54	AAS APHA(22nd Edi)3111 B
6	Arsenic as As	mg/L	BDL*	BDL*	AAS APHA 3114 B
7	Nickel as Ni	mg/L	BDL*	0.19	AAS APHA(22nd Edi)3111 B
8	Total Chromium as Cr	mg/L	0.016	0.011	AAS 3111B
9	Cadmium as Cd	mg/L	BDL*	0.12	AAS APHA(22nd Edi)3111 B
10	Mercury as Hg	mg/L	BDL*	BDL*	AAS APHA- 3112 B
11	Zinc as Zn	mg/L	0.027	1.94	AAS APHA(22nd Edi)3111 B
12	Copper as Cu	mg/L	BDL*	0.87	AAS APHA(22nd Edi)3111 B
13	Iron as Fe	mg/L	0.042	18.06	AAS APHA(22nd Edi)3111 B
14	Insecticides/Pesticides	mg/L	BDL*	BDL*	GC/GC-MS
15	Depth of Water Level from Ground Level	meter	2.4	3.2	--

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

RESULTS OF SOIL

SR. NO.	TEST PARAMETERS	UNIT	RESULT			
			MAY-2017			
			Opp. Dhrub Railway Station	Nr. Flyover Bridge	Nr. Pub Building	CETP Gate
1	pH	--	7.90	7.25	8.21	7.01
2	Nitrogen as N	%	0.0068	0.0092	0.0074	0.0048
3	Phosphorus as P	mg/kg	140	282	190	720
4	Potassium as K	mg/kg	58	40	18	33
5	Baron as B	mg/kg	2.4	1.8	2.6	3.4
6	Calcium as Ca	mg/kg	89.70	445	49.60	1246
7	Magnesium as Mg	mg/kg	5.81	59.42	5.95	1496
8	Iron as Fe	%	0.56	0.48	0.28	0.45
9	Moisture	%	8.4	6.2	10.2	9.8
10	Organic Matter	%	0.054	0.063	0.025	0.04
11	CEC	meq/100 gm	5.4	6.6	4.8	5.1
12	TVC	CFU/gm	2.4×10^{-6}	3.2×10^{-7}	4.2×10^{-7}	3.8×10^{-6}
Heavy Metal						
13	Cadmium as Cd	mg/kg	2.1	4.5	1.8	2.6
14	Thorium as Th	mg/kg	BDL*	BDL*	BDL*	BDL*
15	Antimony as Sb	mg/kg	BDL*	BDL*	BDL*	BDL*
16	Arsenic as As	mg/kg	BDL*	BDL*	BDL*	BDL*
17	Lead as Pb	mg/kg	18.5	30	32.4	18.2
18	Chromium as Cr	mg/kg	15.2	17.2	16.8	17.4
19	Cobalt as Co	mg/kg	1.3	0.8	2.4	1.6
20	Copper as Cu	mg/kg	10.7	11.4	9.8	11.4
21	Nickel as Ni	mg/kg	74	68	140	68
22	Manganese as Mn	mg/kg	210	510	82	154
23	Vanadium as V	mg/kg	10.4	14.8	9.2	7.4

H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

Dr. Arun Bajpai
Lab Manager (Q)

SR. NO.	TEST PARAMETERS	UNIT	MAY-2017
			Near Thermic Fluid Heater (Bitumin)
1	pH	--	7.46
2	Nitrogen as N	%	0.0036
3	Phosphorus as P	mg/kg	410
4	Potassium as K	mg/kg	48
5	Baron as B	mg/kg	1.4
6	Calcium as Ca	mg/kg	129
7	Magnesium as Mg	mg/kg	71.98
8	Iron as Fe	%	0.70
9	Moisture	%	7.2
10	Organic Matter	%	0.032
11	CEC	meq/100 gm	6.2
12	TVC	CFU/gm	2.4×10^{-8}
Heavy Metal			
13	Cadmium as Cd	mg/kg	1.1
14	Thorium as Th	mg/kg	BDL*
15	Antimony as Sb	mg/kg	BDL*
16	Arsenic as As	mg/kg	BDL*
17	Lead as Pb	mg/kg	27.4
18	Chromium as Cr	mg/kg	16.2
19	Cobalt as Co	mg/kg	1.8
20	Copper as Cu	mg/kg	8.6
21	Nickel as Ni	mg/kg	214
22	Manganese as Mn	mg/kg	94
23	Vanadium as V	mg/kg	14.4

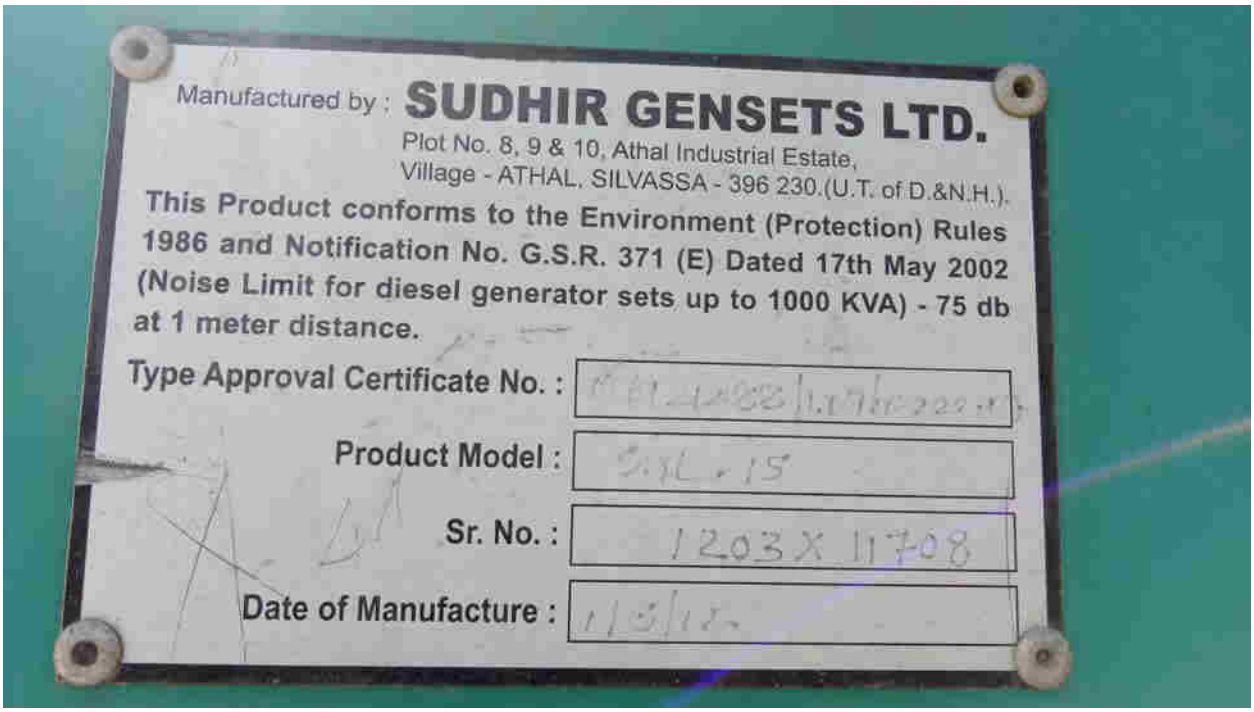
H. T. Shah
Lab Manager

POLLUCON LABORATORIES PVT. LTD. SURAT-3

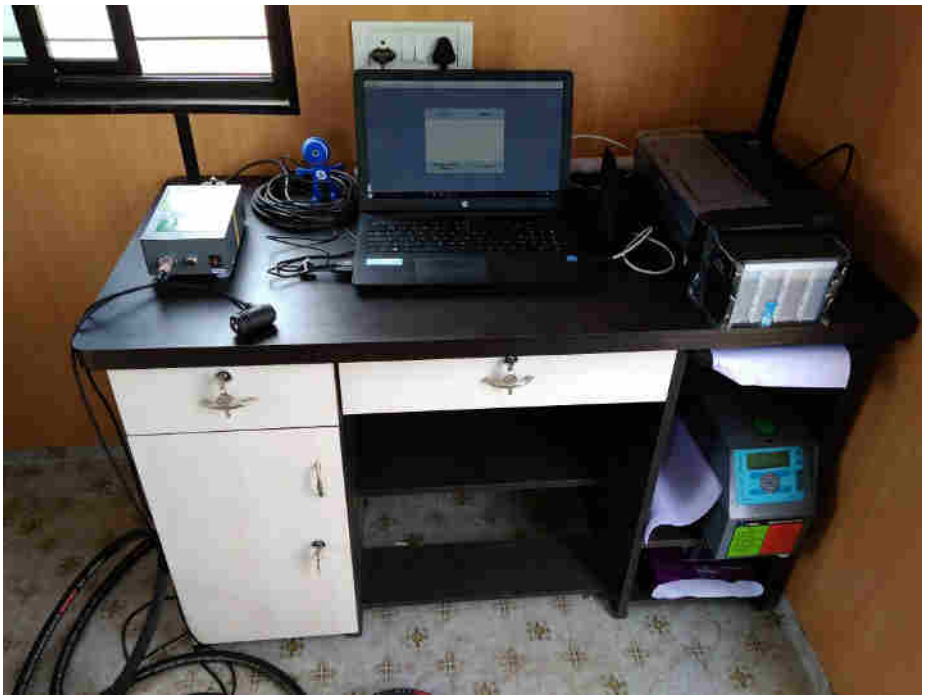
Dr. Arun Bajpai
Lab Manager (Q)

Annexure – 10

❖ **D.G. Set having confirming EPA Norms**



PUC Monitoring Station at APSEZ



4.5 MW Rooftop Solar Plant Installations – APSEZ

Covered Vehicles for Waste Handling

Dignity Of Labours

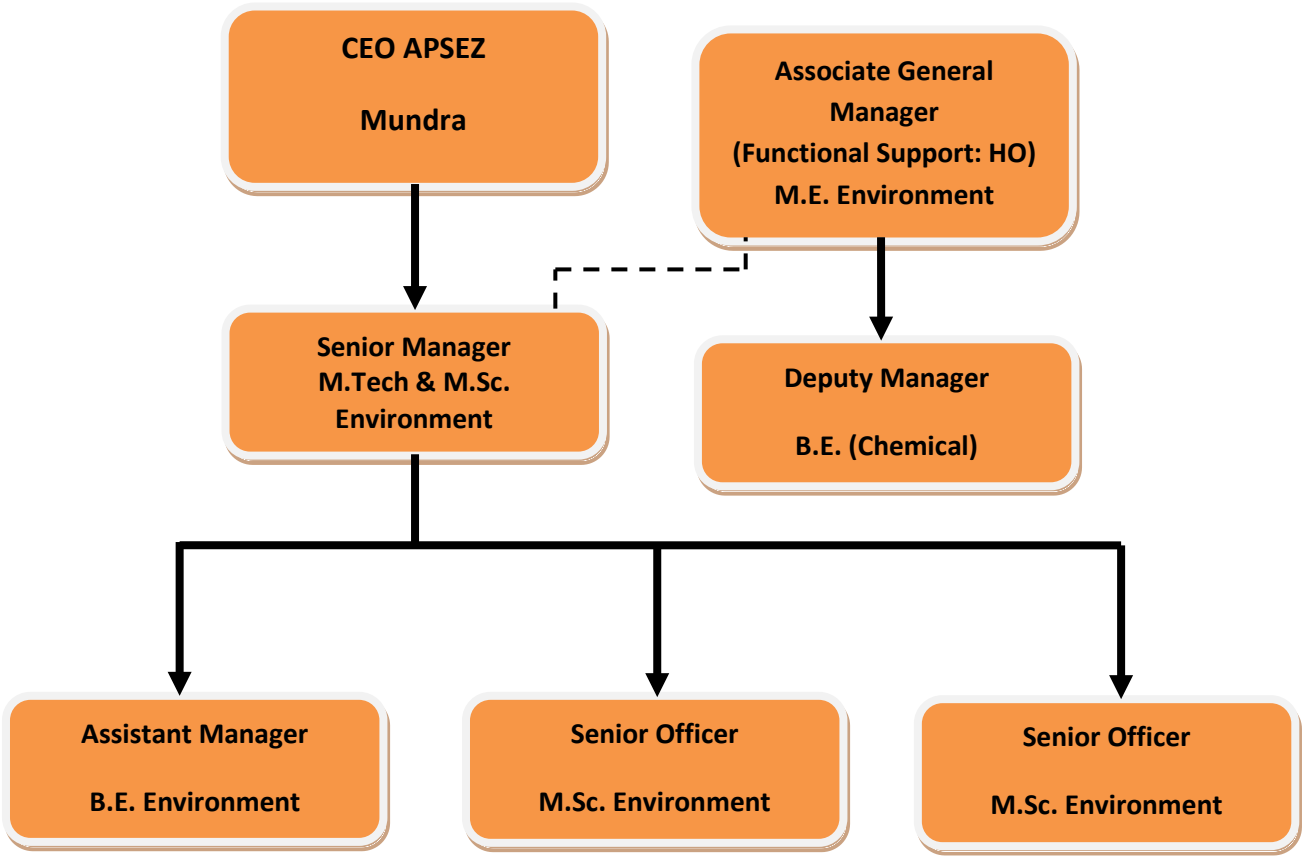
Drives Rest Shed Near North Gate Parking Under the Driver's Dignity

Safety Induction Center Near North Gate Parking Under the Driver's Dignity

Drivers Health Checkup Program in Adani Hospital North Gate Parking Under the Driver's Dignity

Annexure – 11

Organogram of Environment Management Cell, APSEZ, Mundra



Annexure – 12

Cost of Environmental Protection Measures

Sr. No.	Activity	Cost incurred (INR in Lakh)			Budgeted Cost (INR in Lakh)
		2015 – 16	2016 – 17	2017 – 18	2017 – 18
1.	Environmental Study / Audit and Consultancy	45.45	36.78	9.00	21.00
2.	Legal & Statutory Expenses	3.30	4.76	9.48	16.00
3.	Environmental Monitoring Services	26.80	27.95	12.00	36.00
4.	Hazardous / Non Hazardous Waste Management & Disposal	34.56	12.52	31.9	90.84
5.	Environment Day Celebration	7.18	6.71	2.68	10.00
6.	Treatment and Disposal of Bio-Medical Waste	1.22	1.27	0.75	1.44
7.	Mangrove Plantation, Monitoring & Conservation	73.64	72.38	60.0	60.0
8.	Other Horticulture Expenses	434.72	555.00	494.0	556.5
9.	O&M of Sewage Treatment Plant and Effluent Treatment Plant (including STP, ETP of Port & SEZ & Common Effluent Treatment Plant)	18.18	61.50	39.89	69.35
10.	Expenditure of Environment Dept. (Apart from above head)	135.90	131.83	22.83	104.91
	Total	**837.73**	**910.70**	**682.53**	**966.04**

Annexure – 13

2016-17

Doc. No. : EAR 59-1
Date : 21.01.2017
Assign No. : SO/16-17/03594
Date: 25/10/16

adani™

Energy Audit Report Adani House

Prepared for

Adani Ports and Special Economic Zone Limited
Post Bag No. 1, Village - Dhrub,
Tal - Mundra, Kutch 370421
Gujarat

Prepared by

MITCON Consultancy & Engineering Services Ltd.
215, 2nd Floor, Ratna Business Square
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Navrangpura, Ahmedabad-380 009

January -2017

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Delivery Challan No.: EAR 59-1 **Date: 21.01.2017**

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Prepared by: Chintan Shah

Checked By: Shakil Mansuri

Approved by: Deepak Zade

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ABBREVIATIONS

°C	Degree Centigrade
A	Ampere
AC	Alternating Current
Avg.	Average
APSEZL	Adani Ports & SEZ Ltd.
BEE	Bureau of Energy Efficiency
cm.	Centimeter
Cr.	Crore
CHW	Chilled Water
CHWP	Chilled Water pump
CT	Cooling Tower
CW	Cooling Water
CWP	Cooling Water Pump
DC	Direct Current
DG	Diesel Generating
Dia.	Diameter
Ft. or ft	Feet
F.O.	Furnace Oil
FD	Forced Draft
GoI	Government of India
gm.	Gram
hr.	Hour
ID	Induced Draft
Ins.	Insulated
kCal	Kilo Calories
kg.	Kilogram
KL	Kilo Liter
kV	Kilo Volt
kVA	Kilo Volt Ampere
kVAr	Kilo Volt Ampere Reactive
kW	Kilo Watt
kWh	Kilo Watt Hour
Lit	Liter
Lt	Liter
Ltd.	Ltd.
M or m	Meter
Max.	Maximum
MD	Maximum Demand
Min.	Minimum
MITCON	MITCON Consultancy & Engineering Services Ltd.
APSEZL	Adani Ports and Special Economic Zone Ltd
Mm	Millimeter
MT	Metric Ton
MW	Mega Watts
No.	Number
N.G.	Natural Gas
p.a.	Per Annum
PF	Power Factor
Rs.	Rupees
Temp.	Temperature
V	Voltage
VFD	Variable Frequency Drive
yr.	Year

HIGHLIGHTS OF THE REPORT

A.	-	A Profile
• Location	-	Adani Ports & SEZ Ltd., Post Bag No.1 Village Dhrub, Taluka: Mundra, Gujarat
• Year of Establishment	-	
• Business Activity	-	Adani House is a 4 storey building housing several staff offices, auditorium and other business activities
B. Energy Scene		
• Total Annual Energy Bill	-	Rs. 1.241 Cr (Dec-15 to Nov-16)
• Electricity Supply Company	-	MUPL
• HT Connection No. & Contract Demand	-	200033 & 500 KVA
• Major Energy Sources	-	Electricity and Diesel
• Major Connected Loads	-	Package AC, streetlights, pumps, blower, etc.
C. Contact Details		
• Engineer In charge	-	Mr. Sudershan Singh, Dy. Manager (Engineering Services)
• E-Mail	-	sudershan.singh@adani.com 9979869867

D. Key Result Areas for Energy Savings & Estimated Potential along with Broad Cost Benefit.

Sr. No.	Energy Saving Area	Saving Potential in Kwh Lacs	Saving Potential in Rs. Lacs	Investment in Rs. Lacs	Simple Payback Period in Months
I. SHORT TERM AREAS					
1	Energy Saving by setting up VFD control in Raw House Pump 1 & 2 motor	0.1085	0.803	0	Immediate
2	Saving in PAC by overhauling with repairing damage fall ceiling and window curtain	0.152	1.125	0.85	10
3	Saving with AVC in Lightning power	0.175	1.299	0	Immediate
4	Saving with improving power factor		0.060	0	Immediate
	Subtotal (I)	**0.436**	**3.287**	**0.850**	4
II. MID TERM AREAS					
5	Energy Saving by retrofitting VFD in Irrigation Pump motor	0.119	0.879	0.8	11
6	Energy Saving by replacing energy efficient indoor lighting and improving ILER	0.046	0.3432	0.58	21
7	Energy Saving by replacing reverse lighting tubelights with LED strip	0.061	0.449	0.675	19
	SubTotal (II)	**0.226**	**1.671**	**2.055**	15
III. LONG TERM AREAS					
8	Saving With New Technology High Efficiency UPS	2.301	17.026	35	25
	Subtotal (III)	**2.301**	**17.026**	**35.0**	25
Intangible areas of energy saving					
9	Reduction of Room(Open toilet doors etc.) Exhaust for a significant fraction of cleanroom AC energy consumption				
10	Turning off lights in unoccupied areas				
11	The door of the each office entrance has a significant air gap between the frame and the doors meant to Separate Air conditioned Spaces from non conditioned spaces are either missing or kept ajar at all times, Required weather-stripping of all doors				
12	Using Air curtain on ground floor entrance and exit at stairs to curtail infiltration losses the advantages would be more prominent during Summer				
13	Heat load and Heat waves flow direction towards Adani house increases Load on AC system in adani house due to building design of first floor auditorium, without sun film				

Sr. No.	Energy Saving Area	Saving Potential in Kwh Lacs	Saving Potential in Rs. Lacs	Investment in Rs. Lacs	Simple Payback Period in Months
	and Curtain on glasses this will result in increases AC energy consumption of Adani house in summer				
14	Energy Saving in blower power by reducing air changes rate in VRV system				
15	Provision of Return duct for ductable System of Open office area				
16	Replacement of water geyser with solar water heater. Although terrace of many blocks have been used for solar PV system, available empty terraces can be utilized.				
17	Overhaul of Refrigerant Piping Insulation & Filter Maintenance				
18	Optimal AC Temperature Setting				
19	Enhanced Use of Natural Lighting				
20	Building-Envelope & Air-Conditioned Space Insulation				
21	Heat Gain Reducing Paint				
22	Solar panel Installation at Available space of Terrace & Parking				
	Grand total (I+II+III)	**2.963**	**21.984**	**37.905**	**21**

1. Energy Saving by setting up VFD control in Raw water Pump 1 & 2

Sr. No.	Description	Unit	At pump house Raw water supply pump 2	At pump house Raw water supply pump 1
1	Rated HP	HP	10	10
2	Rated Kw	Kw	7.5	7.5
3	Measured Power	Kw	5.94	8.04
4	Opt. Hr/day	hr/day	6	6
5	Motor Efficiency	%	88	88
6	Pump Head	mtr.	33	54
7	Existing Flow	m3/hr	22	34
8	Efficiency of pump	%	37.8	70.7
9	Unit cost	Rs./Kwh	7.4	7.4
10	Annual opt. day	day	350	350
11	efficiency of pump %	%	37.8	64.2
12	Proposed Head	mtr.	35	35
13	Proposed Flow	m3/hr	22	22
14	Estimated power	Kw	5.54	3.27
15	Power Saving	KWH	0.40	4.77
16	Annual saving possible	Rs.	6160	74130
17	Reduce VFD Freq. and running continuous	Rs.	Nil	nil
18	Simple payback period	months	Immediately	

2. Saving in PAC by overhauling with repairing damage false ceiling and window curtain

Sr. No.	Description	Unit	Ground floor, Electric room	1st floor Server room, PAC 2
1	PAC Rated Power Consumption	KW	---	---
3	Measured PAC Power Consumption	KW	11.7	9.14
4	Operating Hours	HR/DAY	6	6
5	Annual Operating Day	Day	360	360
6	Unit cost	Rs./KWH	7.4	7.4
8	Present average specific power consumption	KW/TR	3.97	3.55
9	Proposed Specific power cons.	KW/TR	2.5	2.5
10	Saving in KW	KW	4.3	2.7
11	Saving in Electricity KWH/Annum	KWH	9367	5839
12	Annual saving possible	Rs.	69316	43209

Sr. No.	Description	Unit	Ground floor, Electric room	1st floor Server room, PAC 2
13	Estimated Investment for overhauling, damage false ceiling and window curtain	Rs.	60000	25000
14	Simple payback period	Month	11	7

3. Energy Saving with AVC for Lightning power

Sr. No.	Particulars	Values	Unit
1.1	Measured Lighting load adani House during day time	20.9	kW
1.2	Measured External Lighting load adani House during Night time	9	kW
2	Present Average Voltage at Receiving End (V1)	240	V 1-ph
3	Proposed Operating Voltage after Installing AVC (V2)	230	V 1-ph
4	Power (P1)	V^2/R	
5	Power (P2)	$P1(V2/V1)^2$	
	Proposed power for External light	8.3	kW
	Proposed power for day time	19.2	kW
6	Power Savings at Present Lighting Load	2.4	kW
7	Total Annual Operating Time day and night	7200	Hr
8	Total Saving Potential	17549	kW
9	Total Savings Potential	129863	Rs.
10	Investment for tap changing	0	Rs.
11	Simple Payback Period	Immediate	Month

4. Saving with Improving Power Factor

Month	Unit consumption	Monthly Power Factor	Proposed Power Factor	Rebate Power factor	Rebate on existing power factor	Potential Rebate on proposed power factor
Sep-16	168420	0.99	0.999	0.008	3082	3536
Oct-16	151190	0.99	0.999	0.027	2767	3175
Nov-16	117810	0.98	0.999	0.029	1838	2474
					7687	9185

- As per MUPL Electricity bills Rebate taken on existing power factor is **Rs. 7687**/3months (from Sep 16 to Nov16)

- After Improving Power Factor Potential Rebate on proposed power factor Saving is **Rs. 9185**/3months (from Sep 16 to Nov16), For each 1% improvement in the Power Factor from 90% to 95% Rebate of 0.15 Paise per Unit and For each 1% improvement in the Power Factor above 95% Rebate of 0.27 Paise per Unit
- Average PF is observed **0.957** during field audit
- Saving Achieved is Rs. **5992**/year

5. Energy Saving by retrofitting VFD in Irrigation Pump motor

Sr. No.	Description	Unit	Irrigation pump
1	Rated HP	Kw	
3	Measured Power	Kw	15.1
4	Opt. Hr/day	hr/day	8
5	Motor Efficiency	%	85
6	Pump Head	mtr.	44.4
7	Existing Flow	m3/hr	47
8	Efficiency of pump	%	43.9
9	Unit cost	Rs./Kwh	6.88
10	Annual opt. day	day	350
11	efficiency of pump %	%	43.9
12	Proposed Head	mtr.	35
13	Proposed Flow	m3/hr	50
14	Estimated power	Kw	10.86
15	Power Saving	KWH	4.24
16	Annual saving possible	Rs.	81669
17	Investment Reducing head by reducing frequency with VFD	Rs.	80000
18	Simple payback period	months	12

6. Energy Saving by replacing energy efficient indoor lighting and improving ILER

Location	ILER	Running Hours	Luminary	Existing power consumption	Action	Potential Power Saving
		Hr.		W		kWh/year
Ground Floor Server room	0.284	8760	FTL	148.332	Replace with single 15 W LED	773.8
Ground floor BMS room	0.608	7200	CFL	55.875	Replace with 10 W LED	186.3

Location	ILER	Running Hours	Luminary	Existing power consumption	Action	Potential Power Saving
1st Floor IT office	0.451	2700	CFL	298	Replace with 10 W LED	372.6
1st Floor CSR	0.491	8760	FTL	593.328	Replace with 15 W LED	3095.2
2nd Floor Cubicle 4 LHS	0.336	2700	CFL	167.625	Replace with 10 W LED	209.6
Total Power Saving Potential						4637.4
Saving in cost in Rs.						34317
Total 15 W LED Proposed @Rs. 1500						20
Total 10 W LED proposed @Rs. 1000						28
Investment						58000
Simple payback in Month						21

7. Energy Saving by replacing reverse lighting tube lights with LED strip

Floor	Grd Floor	1st Floor	2nd Floor	3rd Floor
Fixture	Tubelight			
No of fittings	60	56	72	72
Measured power/ luminary(W)	40.889			
Approximate Running Hours	9			
Estimated annual power consumption (kW)	2.5	2.3	2.9	2.9
Power through LED strip 5 meter (Natural light)	25			
Proposed power for 5 meter LED strip (kW)	0.5	0.45	0.625	0.625
Annual Power Saving (kWh)	1324	1670	1670	1407
Total Power saving potential (kWh)				6071
Cost saving Rs. @ 7.4 unit rate				44925.4
Investment for LED Strip (5X90) meter				67500
Simple payback in Month				19

8. Energy Saving With 3 New Technology High Efficiency UPS replacing UPS 2 Ground floor, UPS 1& 2 First floor.

Sr. No.	Description	Unit	Value
1	Working Hours/year	Hr.	8640
2	Power Saving per hour	kW	26.63
3	Electricity Unit rate	Rs.	7.4
4	Energy saving potential	kWh/yr	230083
5	Saving Rs. in year	Rs. In Lakh	17.02

Sr. No.	Description	Unit	Value
6	Investment for New High efficiency UPS x 3 No.s 60 kVA each by replacing UPS 2 Ground floor and UPS 1 & 2 First Floor	Rs. In Lakh	35
7	Simple Payback Period	month	25

Energy Saving in blower power by reducing air changes rate in VRV system

Location	Air Flow (CFM)	Present Fan Power Consumption	Room Area (m2)	Air Changes	Required Air Changes	% Reduction in Air Changes	Power Saving kW
1st Floor RHS Open Office	26131	5.22	537	24	15	57	3.00
2nd Floor LHS Open Office	10218	8.45	244.41	20	15	35	2.98
2nd Floor RHS Open Office	9176	5.16	198.24	22	15	50	2.57
3rd Floor LHS Open Office	11411	3.72	244.41	23	15	51	1.90
3rd Floor RHS Open Office	7727	4.29	198.24	19	15	26	1.12
Total Saving (KW)							11.57
Working Hr. (240 Days @ 10 Hr)							2400
Electricity Saving per Annum							27778
Cost Saving (Rs. 7.4/kWh)							205557
Investment (Rs.)							Nil

Reduction of cleanroom exhaust.

- The energy required to heat and cool cleanroom make-up air accounts for a significant fraction of cleanroom HVAC energy consumption. Measures to reduce cleanroom exhaust airflow volume can therefore lead to significant energy savings.

High-efficiency motors and drives.

- High-efficiency motors reduce energy losses through improved design, better materials, tighter tolerances, and improved manufacturing techniques.
- With proper installation, high-efficiency motors can run cooler than standard motors and can consequently have higher service factors, longer bearing life, longer insulation life, and less vibration.
- Replacing a motor with a high-efficiency motor is often a better choice than rewinding a motor. The practice of rewinding motors currently has no quality or efficiency standards. The efficiency of a motor decreases after rewinding; typically by anywhere from 2-25%. Recent case study data show that new motors are not only more energy efficient, but also reduce overall operation costs. When considering whether to rewind a motor or to replace it with a higher-efficiency model,

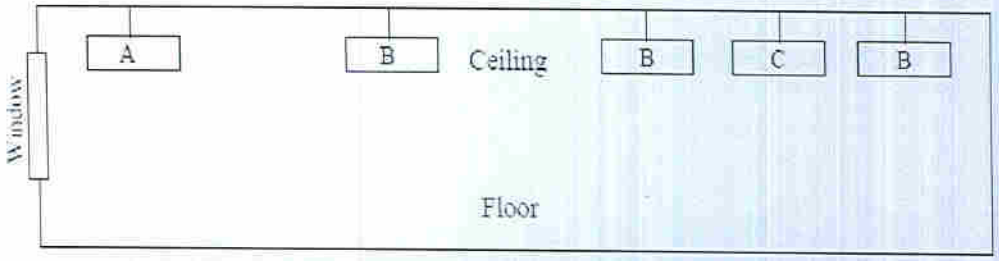
Turning off lights in unoccupied areas.

- An easy and effective measure is to encourage personnel to turn off lights in unoccupied building spaces. An energy management program that aims to improve the awareness of personnel with regard to energy use can help staff get in the habit of switching off lights and other equipment when not in use.

Lighting placement and controls.

- An example of energy efficient lighting control is illustrated by Figure, which depicts five rows of overhead lights in a workspace. During the brightest part of the day, ample daylight is provided by the window and thus only row C would need to be turned on. At times when daylight levels drop, all B rows would be turned on and row C would be turned off. Only at night or on very dark days would it be necessary to have both rows A and B turned on.

Lighting Placement & Control



- retrofit by adapting the luminaries already present. (For example, turning on the lighting in the rows away from the windows during the brightest parts of the day and turning on supplemental rows as needed later.)

Daylighting.

- Daylighting involves the efficient use of natural light in order to minimize the need for artificial lighting in buildings. Increasing levels of daylight within rooms can reduce electrical lighting loads by up to 70% Unlike conventional skylights, an efficient daylighting system may provide evenly dispersed light without creating heat gains. The reduced heat gains will reduce the need for cooling compared to skylights. Daylighting differs from other energy efficiency measures because its features are integral to the architecture of a building; therefore, it is applied primarily to new buildings and incorporated at the design stage. However, existing buildings can often be costeffectively refitted with daylighting systems. Various daylighting systems are available on the market, some of which can be supplied as kits to retrofit an existing building.

PREFACE

- Adani Ports and Special Economic Zone Ltd (APSEZ) is part of Adani Group – a $9.4 billion conglomerate with business is ports and logistics.
  APSEZ represents a large network of ports with India's largest Special Economic Zone (SEZ) at Mundra. APSEZ Business is integral to its Logistics Business done in the name of Adani Ports & Logistics and is India's largest private port operator with presence across 8 locations with state of the art infrastructure.

- Mundra Port, located in the Kachchh district of Gujarat state is the largest among all ports of APSEZ and acts as a gateway for north-western India.

- APSEZ with a total cargo throughput of 127 MMT in 2013-14 is poised to exceed 200MMT of cargo by 2020.

- Adani House built in 2003 is situated at MPSEZ is multi-storey corporate and engineering building having more than 80 offices. Built with modern facilities, Adani house has large office areas, auditorium, library, training rooms and conference rooms. Students from all across the countries visit Adani House to acknowledge the strength and spread of Adani Group.

- Various departments such as asset management, engineering services, port management, etc. are located in the building. Office of top rank managers and officers of Adani Group have their presence at Adani House.

ACKNOWLEDGEMENTS

- An energy audit is a joint venture of consultant and industry to account & contain energy usage without sacrificing the purpose of usage of energy. The contribution of Adani House (APSEZL), Mundra team is equally important in this venture. We sincerely acknowledge the contribution of the following dignitaries and site engineering personnel because of whom the study could progress smoothly –

Sr. No.	Name	Designation
1	Mr. Nirav Shah	Associate Gen Manager (Engineering Services)
2	Mr. Shailesh Kanjariya	Deputy. Manager (Asset Management)
3	Mr. Jagmal Nandaniya	Sr. Engineer (Engineering Services)
4	Mr. Sudershan Singh	Deputy Manager (Engineering Services)
5	Mr. Himanshu Patel	Officer (Asset Management)
6	Mr. Sanjay Trivedi	Engineer (Asset Management)
7	Mr. Vishwajeet Jadeja	Electrical Engineer

- We are also thankful to the other staff members who were actively involved while collecting the data and conducting the field studies.

Chapter 1 Introduction

1.1 PREAMBLE

- Adani Ports and SEZ Ltd. is a well-known name in Ports logistics and customs shipping. The various business carried out in APSEZL included ship docking, ports, logistics, infrastructure, Oil and gas, etc. Adani House is a four storey building that is constructed for major activities such as corporate and engineering offices of APSEZ officers, training and development of new talents, demonstration and meetings for students, investors, technology suppliers and others.
- Average annual energy bill is Rs. 1.241 Cr. (Dec-15 to Nov-16) after deducting PUB Contribution in Electricity bill from Dec 15 to Sep 16. Electricity consumption is shares the major chunk in the total annual energy bill i.e. up to 98.6 %, Energy share of Diesel is nearly 1.4 %.
- In order to reduce increasing energy costs, APSEZL approached MITCON for conduct of energy audit. MITCON submitted its vide proposal no. ECS/EEC/AL/2016-17/366 dated Sep 21, 2016. This proposal was accepted by APSEZL vide its purchase order no. 4800022101 dated Oct 20, 2016.

- This energy audit report for APSEZL, Mundra presents the analysis of the data collected, observations made and field trials undertaken from 20 Dec, 2016 to 30 Dec, 2016. It is governed by the objectives, scope of work, and methodology discussed in ensuing paragraphs.

Baseline Parameters for Energy Audit

Parameter	Value	Unit
Plant Operating Days	300	Days/year
Plant Operating hours	9	Hr/day
Electricity Unit Rate for saving calculation	7.4	Rs./kWh
Diesel unit rate	55	Rs./ltr
Diesel density	0.834	kg/ltr
Diesel GCV	11084	kCal/kg

1.2 OBJECTIVES

- To undertake an energy audit so as to identify areas for energy saving, both without and with investment.

- To compare values for energy consumption as against the occupancy levels and identify potential areas for energy savings / energy optimization (both short-term areas requiring minor investments with attractive paybacks and mid / long term system improvement areas needing moderate investments and paybacks ranging between 12 to 30 months).

- To undertake renewable energy application assessment study.

- To prioritize distinct areas identified for energy savings depending upon saving potential, skills, and time frame for execution, investment cost, paybacks etc.

- To design an "Energy Monitoring System" for effective monitoring of energy consumption and analysis of energy efficiency.

- To provide assistance while implementation.

1.3 SCOPE OF WORK

- To correlate monthly data of occupancy / activity with electricity, diesel and water consumption, for a period of 12 - 18 months of normal operation.
- Estimate Energy Performance Index(EPI) and Average Annual Hourly EPI (AAhEPI)

Part-I

- **Electrical**

- To study electrical energy metering, monitoring and control system existing at site and to recommend a suitable system for future monitoring.
- To study monthly power factor, maximum demand, working hours, load factor etc. for the reference period along with monthly electricity consumption and establish scope for MD control through load optimization of load factor and through detailed load management study.
- To recommend a specific rationalization / optimization program based on measurement of DB power factors, existing capacitor system and its maintenance, automatic / manual controls required etc.
- To study monthly transformer loading with existing & future connected load so as to recommend a specific rationalization / optimization plan for transformer capacity. Analysis of transformer efficiency, losses at various loadings.
- Study of APFC system working on various loadings to understand pattern of various feeders capacitors working.
- To undertake a detailed motor load study on all motors equal to and above 2 kW size with the help of a clamp on load manager to identify instantaneous motor parameters like kW, KVA, P.F., A, V, frequency etc. and establish their variations over a load cycle (for variable load drives, if any). This study will help establish / recommend motor specific rationalization plan including star conversion, downsizing, use of motor energy savers and high efficiency drives etc.
- Based on the above to evaluate the possibility of replacing major motors with energy efficient motors. To provide cost benefit analysis for the replacement policy. Analysis of suitable drive type, alignment etc. to reduce energy consumption.
- To measure current & voltage harmonics of main equipments up to 24th level with 3-Φ power analyzer & to give remedial solutions to remove / suppress harmonics. Suggestion with remedial action to install active / passive harmonics filter.
- Thermography at important electrical PCCs, MCCs & major loads above 63 A switches
- To undertake pumping energy audit on pumps having capacity above 2 kW Pumping audit will mainly cover measurement of water flow, power input, head with digital pressure gauge etc. This exercise will establish the operating duty point of each pump and possibility of energy conservation through pump capacity rationalization, impeller trimming etc. This will help to selection of energy efficient pump running.
- Recommendations on effective & precise control of blowers / fans working with modern control systems. Installation of high efficiency blowers, lobe blowers, aeration blowers for various applications.
- Study of UPS and Voltage Stabilizer System.
- To study compressed air system, in terms of compressor type, make, capacity, loading, motor type / size / loading etc. and to undertake output efficiency test for the operating compressors. This will identify opportunities for compressed air generation optimization and energy savings. Pump up test will be conduct to identify the FAD and leakage volume.

- To undertake compressed air leakages tests & recommend the locations of air leakage. Study of pressure drop and distribution network loop option to precise running of the system.
- To undertake lux survey for the major identified areas and streetlight with the help of a lux meter both during day and night time and recommend a specific plan for rationalization of lighting load through use of north light and switching off use of energy efficient lighting equipment like tri-phosphor fluorescent tube light etc. Possibility checking for installation of LED lighting, occupancy sensor, light pipe, switching point operation.
- Detailed study of streetlight and colony lighting.

- **Water - Basic Study**

- To study water receipt, storage, distribution and utilization in the plant so as to identify scope of water usage and pumping efficiencies.
- Study of R.O or D.M. generation of water & reutilization of wastage water.
- E.T.P./S.T.P. area energy consumption will be study under primary level.

- **Diesel Generator Sets**

- Measurement of electrical energy generated and fuel consumption (based on drop in fuel level)
- Evaluation of specific energy generation ratio (SEGR) and comparing with standards.
- Analysis of loading pattern on diesel generator sets.
- Waste heat recovery system installation option to be study for D.G. Sets.

- **Renewable Energy & Carbon Credits at Preliminary Study**

- To undertake renewable energy application pre-assessment study, which mainly include adaptation of onsite renewable energy technologies like solar power projects, solar thermal systems, biogas etc.
- Pilot study for carbon credits (cost benefit analysis, road map for implementation)

Part-II

- **Air Conditioning System**

- Study of air conditioners performance and efficiency
- Study of utilization factor, operations, running hours reduction by efficient utilization
- Study of maintenance factors
- Study of reduction of heat load, effective area utilization, human general behaviours, history, records, installation locations etc.
- Calculation of energy efficiency index as per standard available practices.

1.4 Methodology

- MITCON deputed following team of experts for conducting the audit and worked in close association with APSEZL.
  - Mr. Deepak Zade, Sr. Vice President
  - Mr. Krunal Shah, Asst. Vice President
  - Mr. Shakil Mansuri, Senior Consultant
  - Mr. Chintan Shah, Project Consultant
  - Mr. Maulik Patel, Certified Energy Auditor
  - Mr. Kalpesh Patel, Associate Consultant
  - Mr. Anand Shah , Associate Consultant
  - Mrs. Sangita Mainkar, Data Management
  - Mr. Jitendra Shinde, Data Management
- MITCON submitted an execution work plan for the assignment for which APSEZL provided relevant data support.
- APSEZL Nominated specific persons from Engr. / Maintenance sections along with a co-ordinator of senior managerial level for this audit.
- MITCON undertook an "Orientation Meeting" with management / Engr. / Maintenance personnel prior to start of the audit. MITCON's team conducted all necessary field trials and measurements.
- MITCON provided all the instruments necessary for conducting the field trials.
- Following instruments were used by MITCON's team.

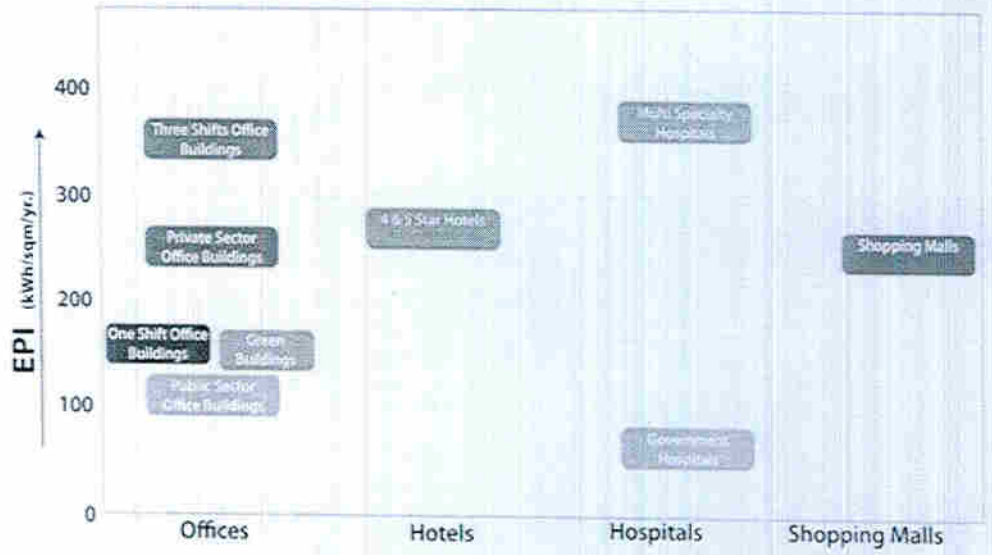
Table 1 Instruments Used by Energy Audit Team

Sr. No.	Instrument Name	Specification
1.	Demand Analyser	Suitable for 1φ, 3φ. 156 electrical parameters like voltage, current, frequency, harmonics, active & reactive power, power factor etc.
2.	Clamp-on Power Meter	0 - 1200 kW 0 - 600 Voltage, AC 0 - 800 Voltage, DC 0 - 2000 A, Current, AC / DC
3.	Lux Meter	0 - 50,000 Lux Level Non Contact Type
4.	Digital Thermo Anemometer	0 - 45 m / sec. ± 3%
5.	Relative Humidity and Temperature Indicator	RH - 10% to 95% Temp. - 0 - 100 °C Handheld unit
7.	Infrared Thermometers	40 °C to 500 °C
8.	Portable Temperature Indicator-Digital	50 °C to 1200 °C
9.	Ultrasonic Flow Meter	0 - 15 m/sec 25 - 5000 mm pipe dia. homogeneous liquids without gas bubbles +/- 0.5 %
10.	Thermal Imager	Measure 0-500 °C of Temperature Profiles of surface area
11.	Multifunction Instrument	Measure °C, air velocity

12.	Digital Pressure Gauge	0 to 30 kg/cm2 with 0.1 kg/cm2 accuracy
13.	Stop Watch	0.00 to 2000 minutes
14.	Sling psychrometer	0-50 °C
15	Laser distance meter	0-40 m lateral distance, room area and volume

1.5 Energy Performance Index

- Energy performance index is Measuring tool to evaluate the performance of the building in terms of the total energy consumption and the total build up area.
- It is calculated by dividing the total energy consumption for a year and total build up area. The units are kWH/annum/m^2
- Total Energy Consumption Energy Bill+Fuel Bill
- Total Build up area in m^2.



Adani house Energy Consumption

Building Energy Consumption							
					Sanctioned demand	500	KVA
Monthly Energy Consumption Pattern							
					Cost		
Month	kWh	KVA	PF	kW	Energy Charges	Demand Charges	Total Cost
Dec-15	118662	517	0.99	765	702083.5	626076	1569562
Jan-16	111606	508	0.99	765	660335.5	626076	1330066
Feb-16	113712	580	0.99	765	672796	585684	1302238
Mar-16	155010	832	0.99	824	917142.5	674361.6	1635602.1
Apr-16	174936	904	0.99	895	1020460	708840	1773572
May-16	216612	1069	0.99	900	1263570	736560	2044602
Jun-16	218424	1052	0.99	900	1274140	712800	2031426
Jul-16	187092	1008	0.99	900	1091370	736560	1872402
Aug-16	168072	892	0.99	883.5	980420	723056.4	1747847
Sep-16	168420	385	0.900	346.5	439775	274428	757560
Oct-16	151190	395	0.97	383.5	340256	213993	597683
Nov-16	117810	319	0.900	340	259888.5	183600	486834

*adani house contributing 60% of total Electricity bill during the month between Dec 15 to Aug 16

- Annual kWh consumption 1901546
- Annual DG kWh generation 5711

- **Total kWh Consumption 1907257**

Total Buildup Area	**unit**	
Adani House	Sq. meter	7908.85
		7908.85
Total kWH/Annum	kWH	1907257
Energy Peformance Index	kWH/Annum/M2	241

EPI Comparison		
Parameter	Actual EPI (kWh/annum/m2)	BEE recommended EPI (kWH/annum/m2)
Energy Performance Index	241	NOT qualify for any of the star ratings available.

Table for Building Energy star rating Programme

More than 50% Air conditioned build up area, Climatic Zone – Warm & Humid

Normalized EPI Bandwidth (kWh/Sqm/Year)	Star Rating
200-175	1 Star
175-150	2 Star
150-125	3 Star
125-100	4 Star
Below 100	5 Star

*REHVA-ISHRAE_EC_BEE

Average Annual Hourly EPI Aah EPI (Wh/hr/Sqm)	Star Rating
54-48	1 Star
48-42	2 Star
42-36	3 Star
36-30	4 Star
30 & Below	5 Star

*REHVA-ISHRAE_EC_BEE

Chapter 2 Back Drop on Energy Scene

2.1 ENERGY SCENE

- Primary energy sources for the plant are Electricity and Diesel. These sources are consumed for the various heating, cooling, lighting applications in the building, operating DG set during power cut off, etc.

- Segregation of annual energy bill is presented in the following figures. Electricity bill share is 98.6% followed by Diesel bill i.e. 1.4% of total energy bill. Diesel contribution is negligible compared to other fuels and resources.

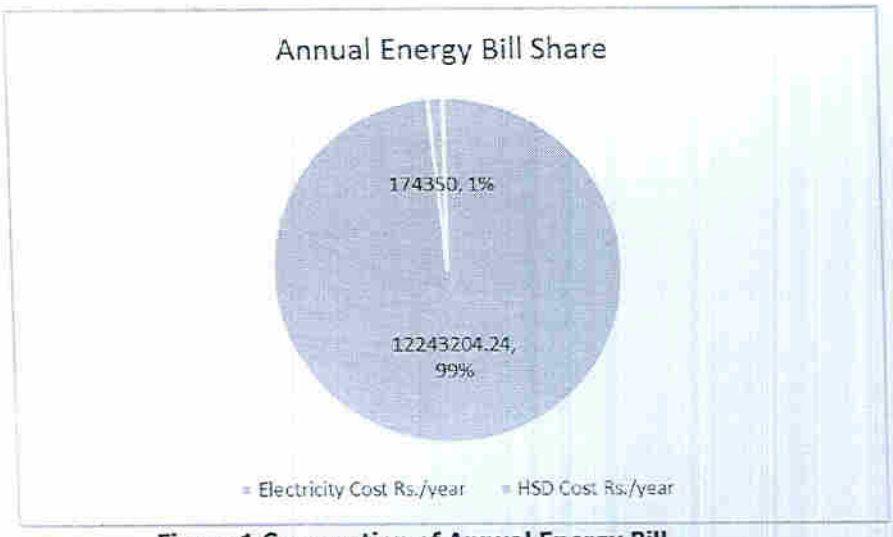


Figure 1 Segregation of Annual Energy Bill

2.2 ENERGY: SOURCES & UTILISATION

2.2.1 Electricity

- The source of outside power for the plant is from MUPL power grid at 11 KV. The power received is further stepped down to 11000 V/430 V through 1 No. 0.63 MVA and is distributed to all power distribution buses.
- Additionally, there is one DG set of 750 KVA to ensure back up power supply to the plant. D.G. set is used as power back up when power is not receiving from electricity grid.
- Present building Contract demand is 500 KVA. Facility actual demand is lower than contract demand in most of the months.
- Electricity Bills from Dec-15 to Sep-16 contained joint meter readings of Adani house+ PMC building and from Set-16 to Nov-16 Adani House Electricity bills are separated from PMC building.

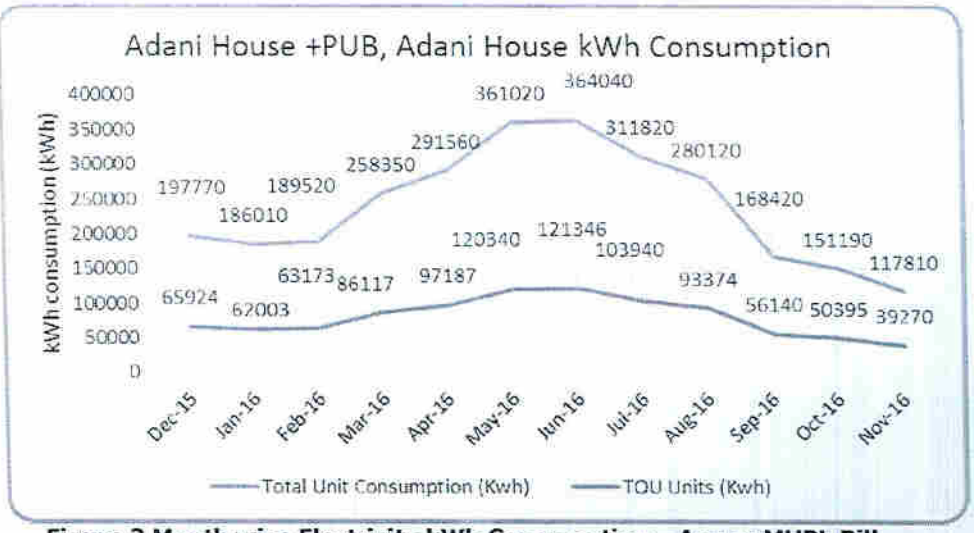


Figure 2 Month wise Electricity kWh Consumption – As per MUPL Bill

- Maximum Consumption observed in the month of Jun-16 whereas minimum consumption observed in the month of Dec-15. Average monthly consumption is 1.45 Lacs kWh. Since the bill consisted of joint meter reading from Dec-15 to Aug-16, the data analysis may not consistent

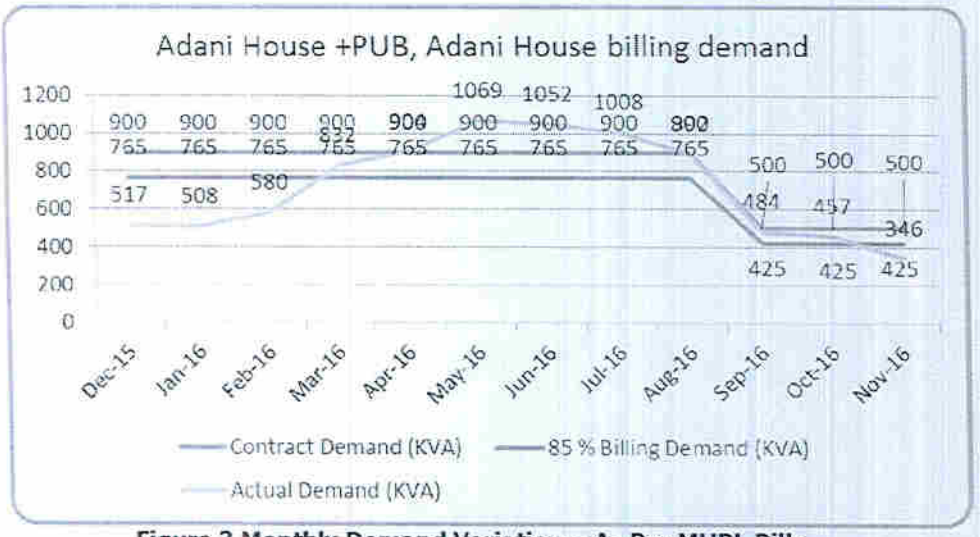


Figure 3 Monthly Demand Variation – As Per MUPL Bills

- Actual Pick demand in the month of May-16 is 1069 KVA. Actual demand is more than contract demand in the months of May June and Jul 16. This may be because of additional cooling requirement in summer season.

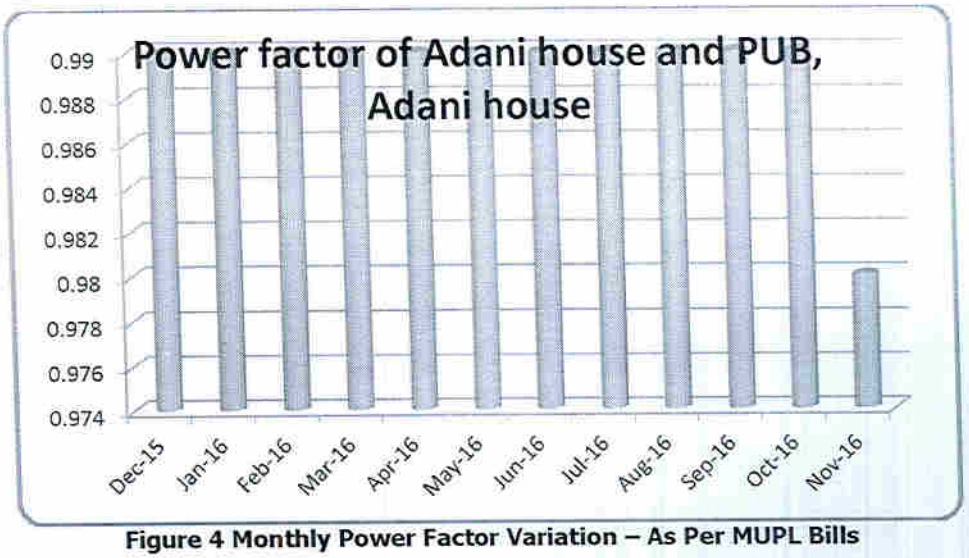


Figure 4 Monthly Power Factor Variation – As Per MUPL Bills

- Average Power factor observed is 0.99. There is a drop in power factor from Nov-16.

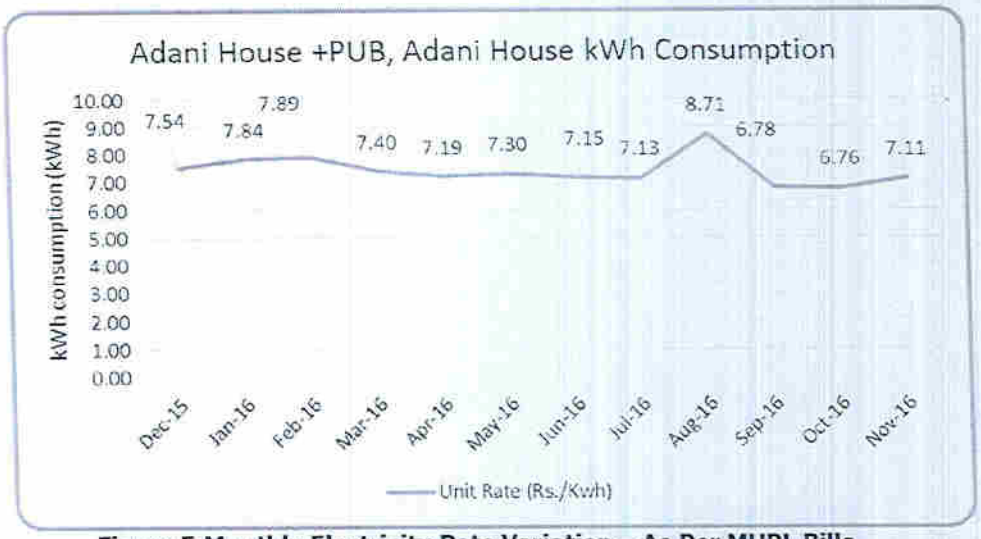


Figure 5 Monthly Electricity Rate Variation – As Per MUPL Bills

- Average unit cost as per electricity bill from Dec-15 to Nov-16 is 7.4 Rs./kWh. For Saving calculation however the average unit rate of last three months when the electricity bills are separate has been considered at 6.88 Rs./kWh.

2.2.2 Diesel

- Diesel is used to run the DG sets to ensure the uninterrupted power supply, whenever distribution Power supply fails. The fuel is also used for vehicle transport but Adani house engineering dept. maintains separate records for both purposes.

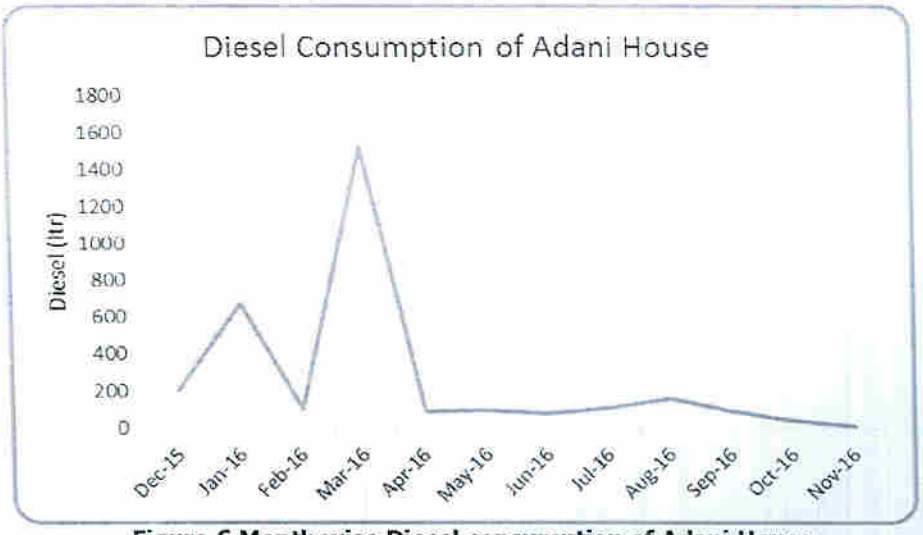


Figure 6 Month wise Diesel consumption of Adani House

2.2.3 Water

- Water is pumped from Narmada River canal and is used for different purposes after appropriate filtration and water quality requirements.
- Adani House having 120 kL sewage Treatment plant, after water treatment about 100 to 120 kL water is used daily in gardening.

2.3 Energy Metering, Monitoring & Control System - Existing Status

2.3.1 Electricity

- Electricity is providing by MUPL at 11 kV. Plant has metering of kWH consumption and power factor monitoring.
- During audit period it is being observed that some of the measured feeders did not have metering of Voltage, Current, kW, P.F. etc. while the energy consumption of utility was taken from their respective control panel.
- kWh and kVAh is being logged in log book by engineering department.

2.3.2 Diesel

- Diesel is being purchased and stored in diesel storage tank. Eng. Department of takes record through level indicator. Diesel is used in DG sets only during power cut off from grid and performance and reliability testing.

2.3.3 Water

- Water a source form plant is Narmada water.
- It is being observed that metering is also for all utilization point so that they can judge the water consumption of separate plant and services.

- Adani House need to recording and monitoring plant water consumption and recycled water on daily basis.
- Water flow totalizers are installed at the STP water pumps for recording.

2.4 Level of Awareness

- Housekeeping is observed in line & maintenance is also observed in good condition.
- Water harvesting & percolation system is not available inside plant area.
- APFC installation at major areas shows the level of awareness in the system.
- Using of natural lighting whenever possible during day time for office use was seen at some places.
- APSEZL Adani house has installed Occupancy sensors at large areas such as staff offices and non-occupancy rooms. These sensors turn on lights immediately as the receive signs of occupancy and switch off after 10 seconds when detect non occupancy.
- Air conditioners with inverters are installed at few places in Adani House.
- Streetlights with LED fixtures has been fitted for reduction of lighting power.
- Built with green building concepts Adani House has optimised room cooling requirement to some extent.
- Non reflective sun films are attached to window glass at almost all the places to reduce room heating due to UV and infrared sun rays.
- Based on geographical time zone, timers for turning on/off streetlights has been installed in Adani House.

Suggestions: -

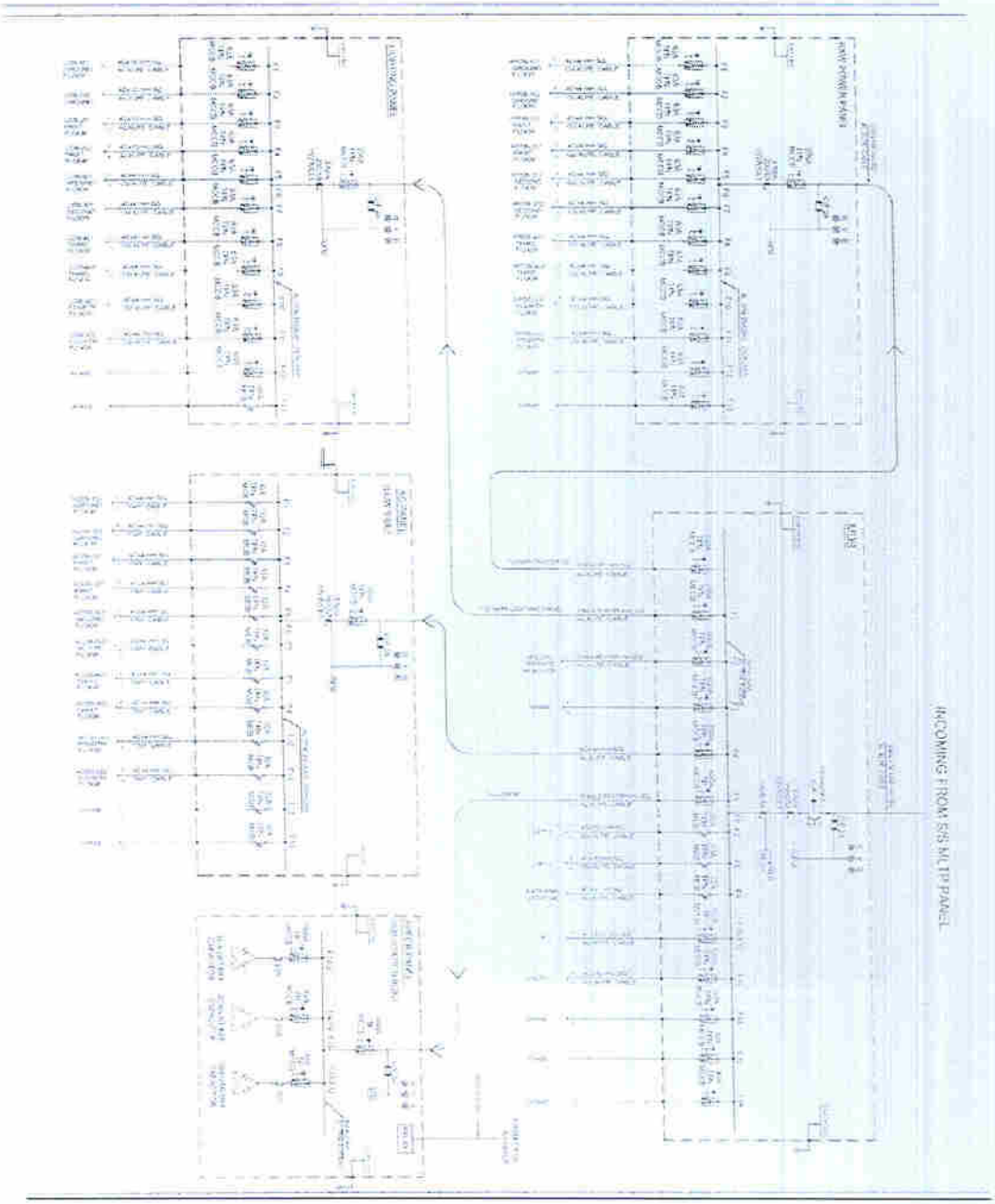
- Open a scheme for obtaining suggestions for conserving energy.
- Display regularly the usage of energy, energy cost & consumption of all departments.

Chapter 3 Energy Conservation Opportunities
(Observations, Field Trials, Analysis and Key Result Areas)

3.1 INTRODUCTION

- The study of plant operations, data collection, observations, field trials and analysis of various areas was undertaken, keeping in view the energy scene at APSEZL, focus areas elaborated in the previous chapter and with a view to identity energy conservation opportunities in the same. The basis for this is the orientation visit, discussions with the plant personnel and the agreed plan for data collection and field trials. All these trials were undertaken at normal operating conditions.

Electrical Single line diagram



3.2 TRANSFORMERS & DISTRIBUTION SYSTEM

- Single line diagram of Electrical System as attached in separate sheet.

Distribution Transformer

- As described earlier, the source of electric power for the plant is from MPSEZ grid at incoming at 11 KV. The power received is further stepped down to 430V through a transformer and is further distributed in plant.
- During audit period performance is tested by measuring parameters in 24 hours for TRF transformer.
- Installation and performance of transformer is as under.

Table 2 Transformer Installation Details

Description	TRF
Make	Siemens
KVA	630
HV Volts	11 kV
LV Volts	0.433 kV
HV AMPS	33 A
LV AMPS	840
Impedance Voltage (%)	NA
Connection	Dy11
Temp Rise of Oil	55 degC
Serial No.	171

Table 3 Electrical parameters of TRF

Parameter	V	A	PF	KW	Hz	% V THD	%I THD
Average	425.8	243	0.957	152.8	50	1.1	11.35
Maximum	432	386.2	0.998	270.3	50.18	1.5	20.1
Minimum	419.7	131.9	0.865	87.9	49.79	0.8	3.6

Table 4 Transformer Efficiency

Sr. No.	Description	Units	TRF
1	Rated KVA	KVA	630
2	Rated No Load Loss	kW	1.26
3	Rated Copper Loss	kW	9.3
4	Average Operating Demand	KVA	157
5	Average Operating Load	kW	152
6	Average Operating PF	P.F	0.968
7	%Loading at Max. Effi.	%	36.81
8	% Loading at Present	%	24.92
9	Operating Load Loss	kW	0.58
10	Total Operating Load Loss	kW	1.84
11	Power Out Put	kW	152
12	Power Input	kW	154

Sr. No.	Description	Units	TRF
13	Efficiency at avg. load	%	98.81
14	Efficiency at max. load	%	98.88
15	Efficiency at min. load	%	98.33

* Considering Average load per day

- 24 hr. power measurement of transformer was conducted which included monitoring of variation in voltage, load, power factor, Current, harmonics and other incidental parameters. The detailed 1-minute interval data logging is available separately in chart and Load cycle as shown below.

➢ **630 KVA Transformer**

The brief summary charts for variation in voltage, Current, Demand & P.F. is presented below.

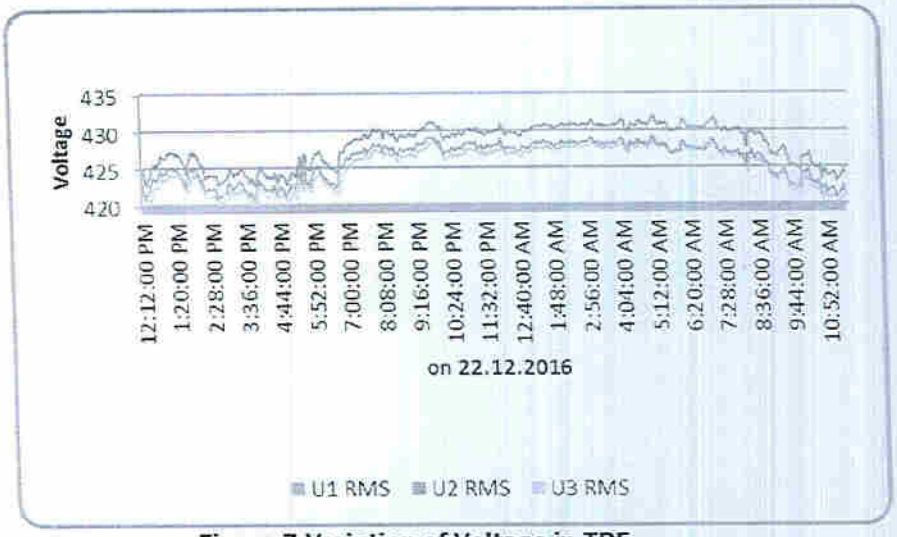


Figure 7 Variation of Voltage in TRF

- The plot of voltage vs. time has been separately prepared to analyse the variation. The same is typical for the day and may vary daily. The chart indicates a normal range of 420 to 431 V with an occasional peak of 432 V and a low of 419 V. The average for the day is 425 V. Voltage measurements at several equipment's over other days also indicates similar pattern.

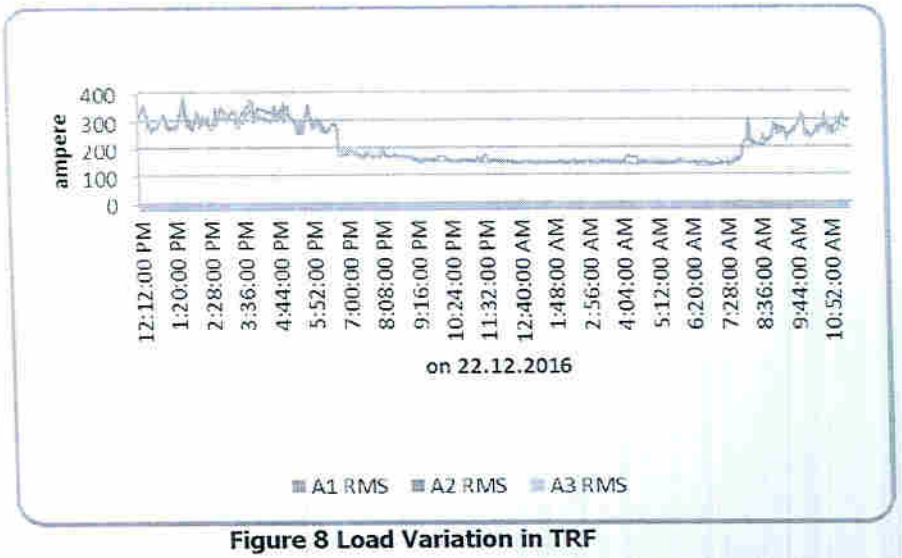


Figure 8 Load Variation in TRF

- The load pattern indicates maximum load 386 A, whereas minimum load is 131 A. Average load observed 243 A.

- The power factor pattern needs to be noted along with the load pattern. As can be noted from below chart, the P.F. goes nearer to unity as load drops and low when the load increases.

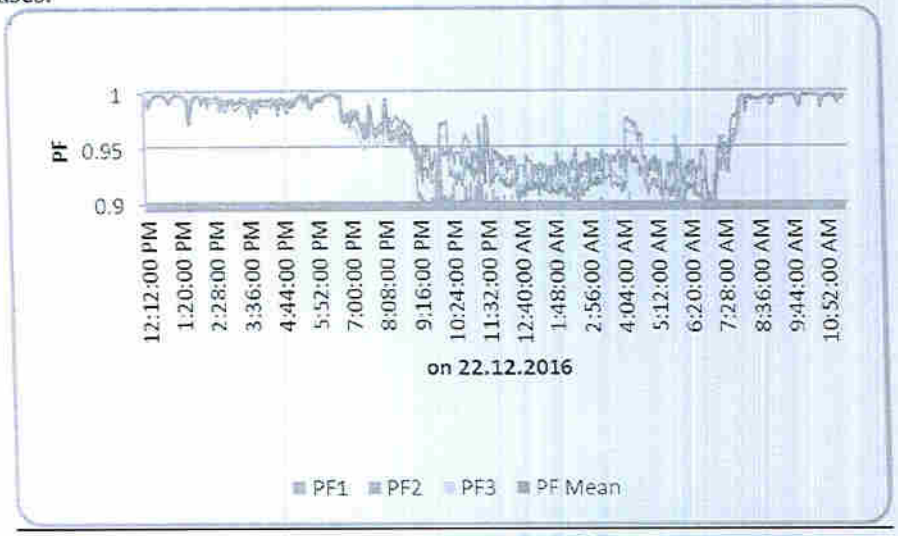


Figure 9 Variation of Power Factor in TRF

- The P.F. is hunting continuously with load indicating that the P.F. system requires fine tuning. The average P.F. is nearly 0.957.

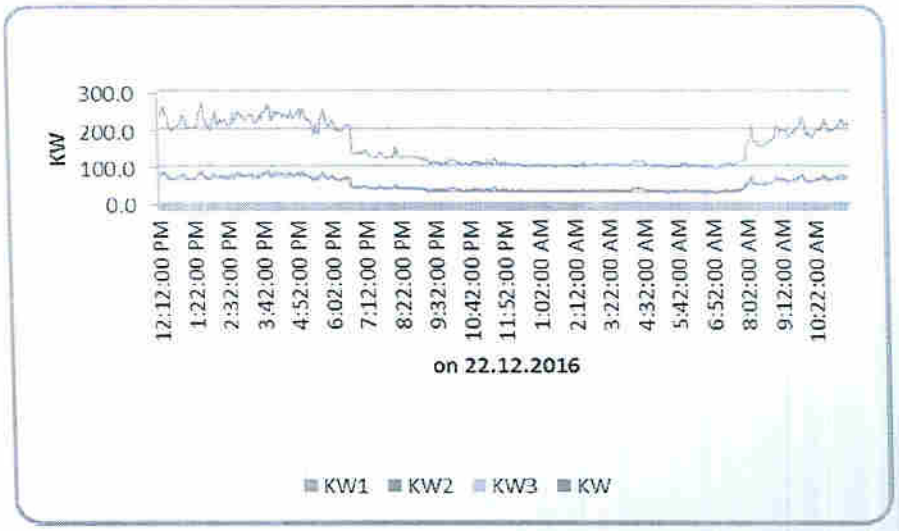


Figure 10 Power Variation in TRF

- The load pattern indicates maximum power 270.3 kW, whereas minimum power is 87.9 kW. Average power observed 152.8 kW.

Observation & Recommendations for Electrical distribution system

- 1 transformers is installed in AH.
- TRF is operated at 28-36 % load.
- Energy monitoring is done by maintaining the record of energy consumed by utilities that has their electronic control and display.
- It is recommended that EMS should be installed in the plant so that the metering and monitoring of electrical energy consumption can be further improved.

3.3 APFC

- APFC Panels are installed in each plant and in some PCCs as well as some MCCs throughout the plant.

3.3.1 APFC Performance Details

Table 5 300 KVAR PCC Room APFC Performance

Sr. No.	Location	Total Installed KVAr	Individual Capacitor Kvar	R-Phase Current	Y-Phase Current	B-Phase Current	Calculated KVAr	% Loading	Remarks
1F3	ADANI HOUSE ELECTRICAL ROOM	290	40	not working					Damaged
1F4			40	46.6	46.8	46.6	35	88	Healthy
1F5			40	35.6	35.6	37.3	27	68	Derated
1F6			20	22.8	21.9	22.4	17	84	Healthy
2F1			20	27.9	27.5	27.6	21	104	Healthy
2F2			20	27.8	28	28.4	21	106	Healthy
2F3			20	28.5	28.5	29.5	22	108	Healthy
2F4			20	33.8	33.8	34.0	25	127	Healthy
2F5			20	28.6	28.1	28.2	21	106	Healthy
2F6			20	27.1	27.4	28.2	21	104	Healthy
2F7			20	28.0	27.4	27.4	21	104	Healthy
2F8			10	14.2	14.2	14.3	11	107	Healthy

- Most of capacitor observed in healthy condition. It is recommended to replace capacitor bank of 1F3 and 1F5 with that of new and healthy capacitors.

Observations & Recommendations

- From the present electricity bill analysis and power factor measurement the present average PF of 0.99 to 0.98 (Sep 16 to Nov 16), and from the Load Cycle it was 0.957 in that case further improvement is Required.
- It is observed that during low load condition the capacitor banks do not automatically cut off and leading power factor is observed during such time Plant voltage rises from 2-3 V during such time.
- It is recommended that set point of APFC to be set at unity power factor and it is to be operated in auto mode.

Adani house PF Improvement saving for last three month

Month	Unit consumption	Monthly Power Factor	Proposed Power Factor	Rebate Power factor	Rebate on existing power factor	Potential Rebate on proposed power factor
Sep-16	168420	0.99	0.999	0.008	3082	3536
Oct-16	151190	0.99	0.999	0.027	2767	3175
Nov-16	117810	0.98	0.999	0.029	1838	2474
					7687	9185

- As per MUPL Electricity bills Rebate taken on existing power factor is **Rs. 7687**/3months (from Sep 16 to Nov16)
- After Improving Power Factor Potential Rebate on proposed power factor Saving is **Rs. 9185**/3months (from Sep 16 to Nov16), For each 1% improvement in the Power Factor from 90% to 95% Rebate of 0.15 Paise per Unit and For each 1% improvement in the Power Factor above 95% Rebate of 0.27 Paise per Unit
- Average PF is observed **0.957** during field audit
- Saving Achieved is Rs. **5992**/year

3.4 HARMONICS STUDY

- Harmonics are one of the most well-known power quality phenomena and are the result of the distortion of sinusoidal signal of the voltage and / or current. Distorted waveforms can be broken down into sum of components at the fundamental frequency and at the frequencies multiple of the fundamental one. Harmonics are signal components with frequencies that are integer multiples of the fundamental operating frequency of the system.

- The distortion of the sinusoidal waveform and the presence of harmonics are originated by the nonlinear characteristics typical of several devices like UPS and other electronic equipment etc. It is common to use general indexes of harmonics distortion such as Total Harmonic Distortion (THD), a parameter that briefly quantifies the harmonic distortion of a signal.
- The presence of harmonics in a network with capacitors causes a current overload on the capacitor itself and results in increase in temperature and reduces the life of capacitors. Further, the problems that may originate from the presence of harmonics are overload in the PF correction capacitor banks, overload of the neutral conductor, additional losses in transformers and in rotating electrical machines, measurement errors in the counters and untimely triggering of safety relays, disturbance and faults in electronic equipment and computers.

➢ **Effect of Harmonics:** The presence of harmonics in a network would result in:

- Current overload on the capacitor and increase in temperature which reduces the life of capacitors.
- Increased resistance of conductors thereby increased losses and thermal failures.
- Additional losses in transformers and in rotating electrical machines.
- Measurement errors in the counters and untimely triggering of safety relays.
- Disturbance and faults in electronic equipment and computers.
- Study of harmonics was carried out for approximately for 24 hours at an interval of 1 minutes and the summary of observations are presented below.

Below figures shows IEEE standard for voltage and current harmonics.

Table 6 IEEE standard for voltage harmonics as per IEEE 519

Low-voltage system classification and distortion limits			
	Special Applications[1]	General System	Dedicated system[2]
Notch Depth	10%	20%	50%
THD (voltage)	3%	5%	10%
Notch Area[3] (A_N)	16400	22800	36500
Note: The value A_N for other than 480 V systems should be multiplied by V/480 1. Special applications include hospitals and airports 2. A dedicated system is exclusively dedicated to the converter load 3. In volt-microseconds at rated voltage and current			

Table 7 IEEE standard for current harmonics as per IEEE 519

Current Distortion Limits for General Distribution System (120 V through 69000V)
Maximum Harmonic Current Distortion in Percent of I_L

Individual Harmonic Order (Odd Harmonics)				
I_{SC}/I_L	≤11	11≤h≤17	17≤h≤23	TDD
<20*	4	2	1.5	5
20<50	7	3.5	2.5	8
50<100	10	4.5	4	12
100<1000	12	5.5	5	15
>1000	15	7	6	20

Where:

I_{SC}= maximum shot circuit current at PCC

I_L= maximum demand load current (fundamental frequency component) at PCC

- As per described in above measurement and standard it is suggested to put harmonics filter for better quality of power. We had suggested vender for harmonics filter. Plant person called them for site visit and detail discussion. Initially plant person put harmonics filter only for transformer 13. It is suggested by vender that to eliminate harmonics losses install harmonic filter at load end and reduce harmonic generation in line, also put one harmonic filter at a transformer to reduce harmonic generation in grid. As above it is suggested that install Adv. Passive filters at distribution side. And put one active filter at transformer side.
- $I_{rms}= I_1(1+THD^2)^{0.5}$, where: I_1= Fundamental current, Above equation shows that reduction in harmonics is reduction in losses ($I_{rms}= I_1$, where: THD=0). Harmonics increase rms current for a load drown a fundamental current, also its increase in joule losses, not taking in the account but skin effect.

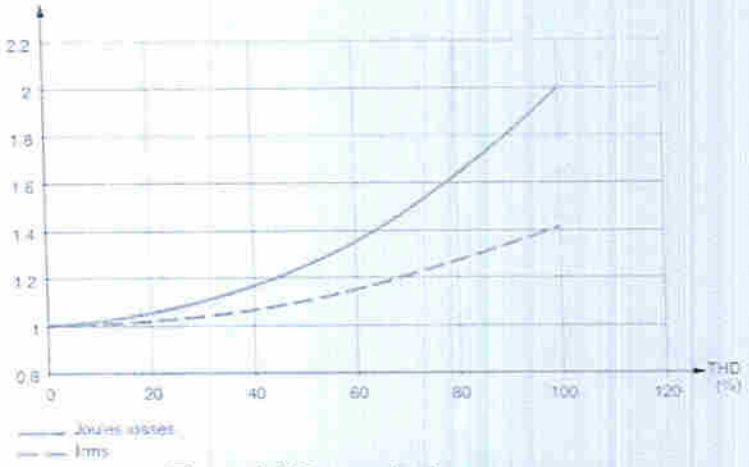


Figure 11 Harmonics losses

(The reference point in graph is 1 for I_{rms} and joules losses, the case when there are no harmonics)

Table 8 Harmonics Level on Transformer LT Side

Equipment	THD V % (Range)			THD I % (Range)		
	R	Y	B	R	Y	B
TRF	0.8-1.4	0.8-1.3	0.9-1.5	4.4-18.7	4.2-20.1	3-18

- Voltage harmonics (% total harmonic distortion) recorded at the transformer side is not within specified limits by ANSI Standard IEEE 519 - 1992 which is 3% of Voltage Harmonics and 5% whereas current harmonics. It is suggested to carry out a detailed harmonics study over a period of time such that THD is maintained within safe limits. A

typical study would record **3rd, 5th, 7th, 9th, 11th and higher currents Harmonics** to detect the source and suitable **Active or Passive filters** to suppress it.

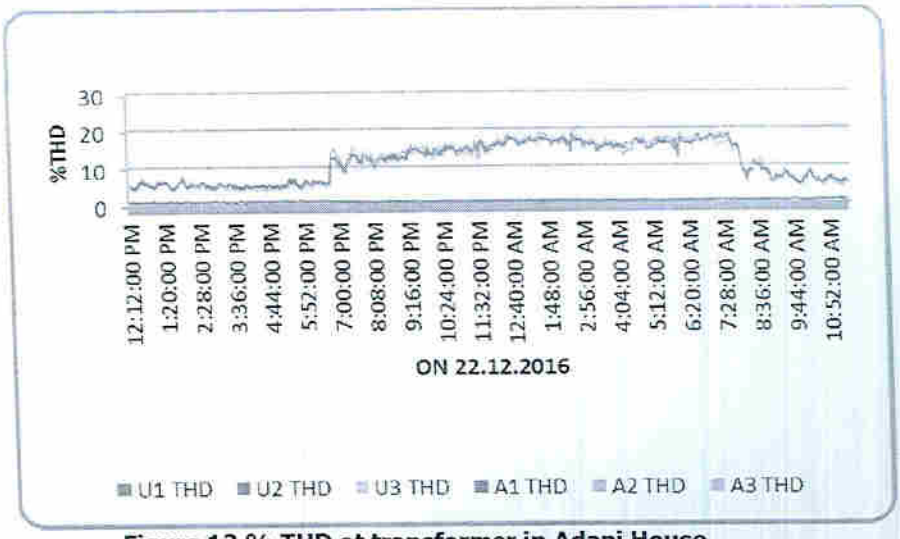


Figure 12 % THD at transformer in Adani House

3.4.1 PCC/MCC Wise Harmonics Generation:

- Instant measurement of harmonics levels in PCC/MCC/PDB/MLDB panel has been taken. It is observed that some panel harmonics observed higher side and marked bold at following table. **Possibilities of installing harmonics filter at high % THD A area or main PCC panels will improve power quality and thus will improve energy efficiency as well as electric equipment life.**

Table 9 PCC/MCC Wise Harmonics Generation

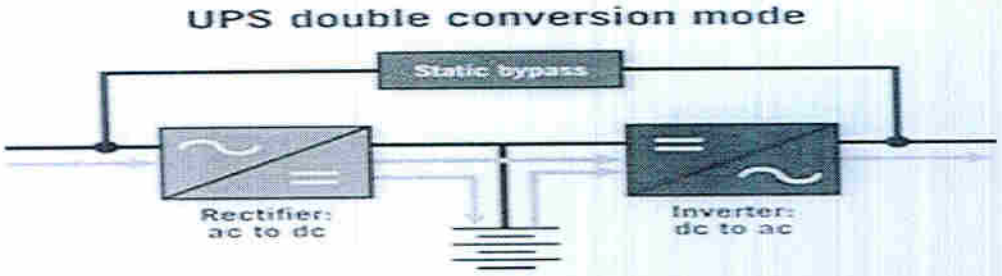
Sr. No.	Identification	Volt	Amp.	KW	PF	%THD (V)	%THD (A)	ORDER				
								3RD	5TH	7TH	9TH	11TH
1	120 kVA UPS 2	418	40.7	11	-0.39	1.28	17.4	5.7	9.0	9.9	4.5	3.2
2	Raw Power DB	416	10	6.95	0.97	1.2	25.4	18.0	12.2	6.8	4.6	1.3
3	Main Lightning panel	416	26.8	14.9	0.77	1.3	12.3	10.1	---	3.2	---	1.1
4	APFC Panel	420	63.5	46	0.99	1.2	42.5	10.2	33.6	19.1	2.9	5.2
5	UPS 120 kVA 1	420	39.8	12.40	-0.43	1.8	16.4	3.2	9.2	11.2	---	5.0
6	UPS 120 kVA 3	421	40	12.4	-0.43	1.6	16.5	6.4	9.5	11.1	---	4.4
7	Law AC Panel	423	88.6	55.4	0.85	1.6	2.9	2.5	1.2	---	---	---
8	UPS 30 kVA 1	420	16.6	10.6	0.87	1.4	80.3	1.8	67.6	43.0	---	3.3
9	UPS 30 kVA 2	415	17.3	11.00	0.88	2.1	79.5	6.3	67.6	40.5	2.9	0.9
10	Kitchen LDB	422	10.4	6.40	0.84	1.6	1.03	---	0.6	0.5	--	0.8
11	Emersion Outdoor(spare)	418	10.3	5.18	0.69	1.4	3.7	---	2.4	---	---	---
12	RPDB 101	417	7.17	4.99	0.96	1.4	19.9	14.8	11.4	3.6	---	---
13	RPDB 102	417	8.51	6.09	0.99	1.1	1.3	---	---	---	---	---
14	RPDB 201	420	8.64	6.15	0.98	1.6	50.4	20.9	21.0	20.0	20.3	---
15	RPDB 202	NO LOAD										
16	RPDB 301	NO LOAD										
17	RPDB 302	418	11.20	8.05	0.99	1.3	5.4	3.4	2.6	1.8	0.7	---
18	RPDB 401	NO LOAD										
19	RPDB 402	421	11.80	8.61	1.00	1.4	3.6	1.4	2.2	0.7	0.6	0.3
20	RPDB 501 & 502	NO LOAD										
22	Canteen Exshaust fan	401	8.65	2.46	0.41	1.6	1.8	---	---	---	---	---

3.4.2 Observations & Recommendations

- 3rd, 5th and 7th order harmonics are observed above limits as per IEEE-519 standards in majority PCC and MCC.
- The presence of harmonics in system is majorly due to nonlinear and variable frequency drives.
- To curb the harmonic interference degrading power quality of the system it is recommended that a harmonic filter should be installed. It will not only ensure service life of low load and electronic controllers but will also cap the energy wasted in harmonics.
- % A THD of APFC panel, UPS panels and RPDB 101, 201 is observed higher than 15 %. UPS with poor conversion efficiency induce current harmonics into system. It is recommended to install harmonic filters with inverter to improve power quality.

3.5 UPS SYSTEM

- Adani House has 5 UPS of different capacity installed for providing back up and emergency power to data centre and server rooms.
- The VFI topology is more commonly known as double-conversion or "online" UPS, where in normal operation, the rectifier/inverter circuits are online and engaged. Power is converted from ac to dc in the rectifier and then from dc back to ac in the inverter. Additionally, dc power is used to charge the stored-energy medium under normal operation, and draw power from the stored-energy medium during a power outage. Different technologies can be used for the stored-energy medium including batteries and flywheels. Double-conversion UPS systems are also equipped with a static bypass path that bypasses the rectifier/inverter circuit during a fault condition.



- The installation and operating details are as mentioned bellow:

Table 10 UPS Installation Details

Sr. No	Location	ID	Rating in KVA	Make	Battery	Technology
1	Adani House (Ground floor)	UPS 1	120	Emerson Network	Lead Acid	On Line
2	Adani House (Ground floor)	UPS 2	120	Emerson Network	Lead Acid	On Line
3	Adani House (Ground floor)	UPS 3	120	Emerson Network	Lead Acid	On Line
4	UPS ROOM (1st Floor)	UPS 1	30	Emerson Network	Lead Acid	On Line
5	UPS ROOM (1st Floor)	UPS 2	30	Emerson Network	Lead Acid	On Line

3.5.1 Performance Details

Table 11 Adani House 120 kVA UPS 1

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	424	40.4	12.8	-0.43	29.8					3.35	15.1
	Y	427	40.4	11.8	-0.4	29.5					3.41	15.2
	B	425	41.2	12.3	-0.41	30.0					3.39	14.4
UPS Output	R	395	13.4	7.71	-0.85	9.1	0	100	456	50	3.3	23
	Y	395	20.6	11.5	-0.82	14.0	0				3.2	18
	B	395	15	7.87	-0.77	10.2	0				3.3	26

Table 12 Adani House 120 kVA UPS 2

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	426	41.2	11.1	-0.36	30.8					1.37	14.9
	Y	424	41.3	9.90	-0.30	33.0					1.11	13.9
	B	423	42.9	11.5	-0.36	31.9					1.43	17.0
UPS Output	R	395	15.3	9.80	-0.98	10.0	0	100	456	50	3.33	43.8
	Y	395	8.66	5.73	-0.96	6.0	0				3.33	45
	B	395	10.1	6.72	-0.97	6.9	0				3.19	43.6

Table 13 Adani House 120 kVA UPS 3

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	422	41.3	12.2	-0.40	30.5					1.37	14.9
	Y	425	40.3	12.4	-0.40	31.0					1.11	13.9
	B	421	41.1	13.0	-0.43	30.2					1.43	17.0
UPS Output	R	395	11.9	8.07	1.00	8.1	0	100	456	50	3.53	12.7
	Y	396	17.4	11.9	1.00	11.9	0				3.6	13.2
	B	395	17.3	11.8	1.00	11.8	0				3.42	11.1

Table 14 Adani House UPS 1 1st Floor 30 kVA

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	414	16.9	10.2	0.84	12.1					1.63	76
	Y	414	17	11.1	0.91	12.2					1.6	77
	B	414	11.8	7.70	0.91	8.5					3.5	9.0
UPS Output	R	397	8.06	5.00	-0.90	5.6	0	100	427	50	3.32	10.2
	Y	397	11.7	7.49	-0.94	8.0	0				3.32	10.4
	B	394	9.17	5.96	-0.95	6.3	0				3.31	10.2

Table 15 Adani House UPS 2 1st Floor 30 kVA

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	418	16.4	10.2	0.84	12.1					1.7	62
	Y	418	17	10.7	0.88	12.2					1.8	74
	B	421	16.1	10.3	0.88	11.7					2.1	69.0
UPS Output	R	399	6.54	4.00	-0.90	4.4	0	100	426	50	2.9	10.5
	Y	397	11.7	7.04	-0.87	8.1	0				3.1	11.2
	B	395	8.03	4.92	-0.90	5.5	0				2.8	12.6

Table 16 UPS performance details

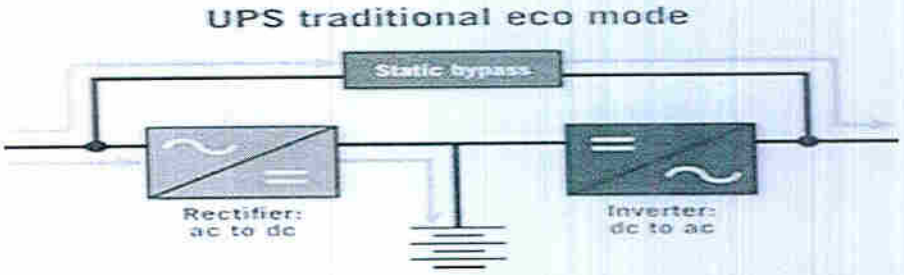
Location	Tag	Input kW	Output kW	% conversion efficiency
Adani House	UPS 1	36.9	27.1	73.39
Adani House	UPS 2	32.5	22.3	68.46
Adani House	UPS 3	37.6	31.8	84.49
Adani House	UPS 1 First Floor	29.0	18.5	63.62
Adani House	UPS 2 First Floor	31.2	16.0	51.15

3.5.2 Observations & Recommendations

- UPS rooms are installed in air conditioned room where the room temperature is maintained between 22 to 25 °C and 50 to 60 % RH.
- From the % loading of each UPS it is observed that the UPS are operated below 50 % load for 120 kVA capacity.
- % conversion efficiency of UPS 2 first floor is observed to be 63.6 and 51.1 % which is well below the standard operating efficiency. It is recommended to replace UPS with energy efficient UPS.

Traditional eco mode

- In the traditional or classic eco mode, the load is normally powered through the bypass path, exposing the critical load to the raw utility power without conditioning, similar to the VFD topology. The inverter is in standby and only engaged when the utility fails. Because of this, the losses in the rectifier and inverter are eliminated, making the UPS system more efficient.



- The average static double-conversion UPS system operates between 90% efficient at 30% load to about 94% efficient at 100% load. The efficiency percentage can go up or down a little depending on the technology used, and whether the UPS contains an input isolation transformer. With the elimination of the rectifier and inverter losses, the efficiency of the UPS system in eco mode can increase to 98% or 99%. In a 2N redundant-type (system + system) configuration, where the system is typically operating each UPS below 40%, that equates to about a 4% to 8% increase in efficiency. The increase in efficiency also means less heat, which reduces cooling requirements. The Green Grid estimates an average improvement of approximately 0.06 in PUE when going from double-conversion to eco mode.

Table 17 UPS performance study

Location	Tag	Input kW	Output kW	%Load	efficiency	Losses kW	Losses(kW) at 90% efficiency
Ground Floor	UPS 1	36.9	27.1	23	73	9.8	3.69
Ground Floor	UPS 2	32.5	22.3	19	69	10.2	3.25
Ground Floor	UPS 3	37.6	31.8	27	85	5.8	3.76
First Floor	UPS 1	29	18.5	62	64	10.5	2.9
First Floor	UPS 2	31.2	16	53	51	15.2	3.12
Power losses per hour						51.5	16.7
Savings per hour							34.8

Table 18 Saving With New Technology High Efficiency UPS

Sr. No.	Description	Unit	Value
1	Working Hours/year	Hr.	8640
2	Power Saving per hour	kW	26.63
3	Electricity Unit rate	Rs.	7.4
4	Energy saving potential	kWh/yr	230083
5	Saving Rs. in year	Rs. In Lakh	17.02
6	Investment for New High efficiency UPS x 3 Nos. 60 kVA each by replacing UPS 2 Ground floor and UPS 1 & 2 First Floor	Rs. In Lakh	35
7	Simple Payback Period	month	25

3.6 DG Set

3.6.1 Installation Details

- 1 no. of DG set of 750 kVA is installed in the DG House of Adani House, it will running only during power cut off.
- Installation details are as mentioned in below table:

Table 19 DG installation details

Particulars	DG1
Make	Cummins India Ltd.
Location	Adani House
Rated kVA	750
Rpm	1500
Engine no.	7020881
Amp	1043
PF	0.8
Excitation volt	52
Running hours	1085.7
Volt	415
Make(generator)	Stamford

3.6.2 Operation and performance details

Table 20 operation and performance details of DG set

Sr. No.	Description	Units	Adani House
1	Starting energy meter reading	kWh	0
2	Ending energy meter reading	kWh	36.215
3	Start fuel tank reading	Ltr.	644
4	End fuel tank reading	Ltr.	634
5	Specific Fuel Consumption	Ltr./kWh	0.276
6	Generating Electricity	kWh	36.215
7	Fuel used	Ltr.	10
8	Capacity of DG set	kVA	750.0
9	Operating Power factor	PF	0.5
10	Specific Fuel Consumption	kWh/lit.	3.62

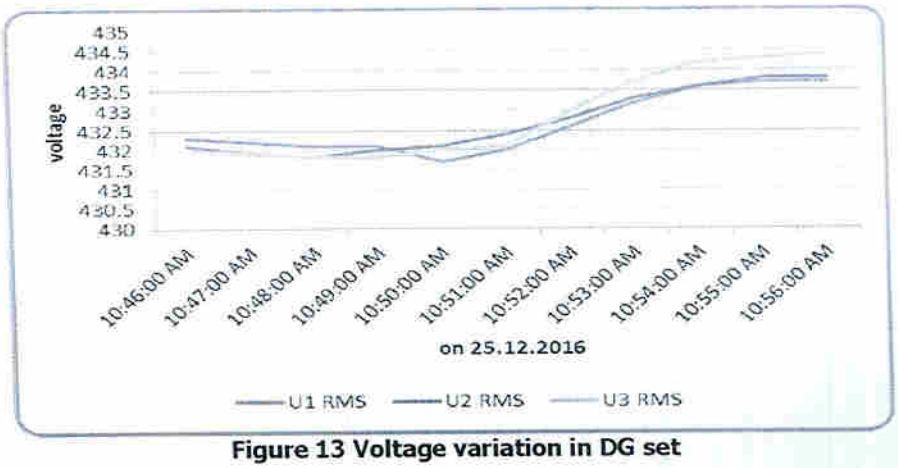


Figure 13 Voltage variation in DG set

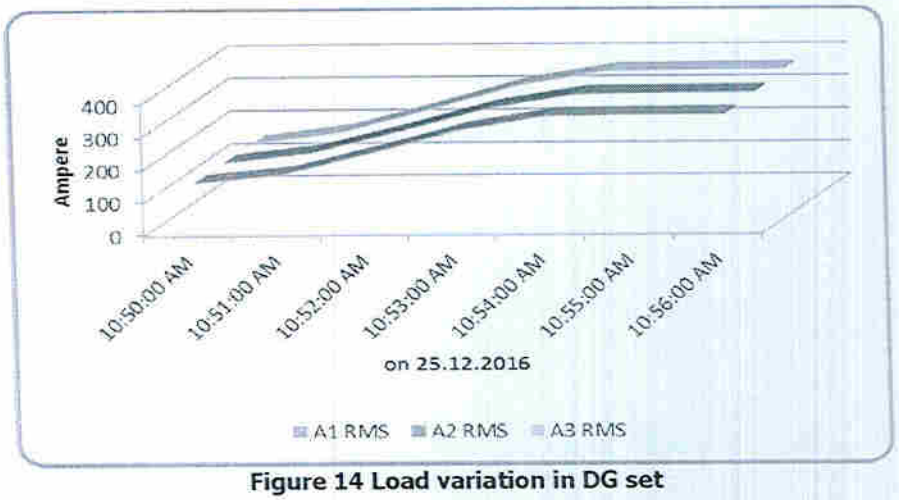


Figure 14 Load variation in DG set

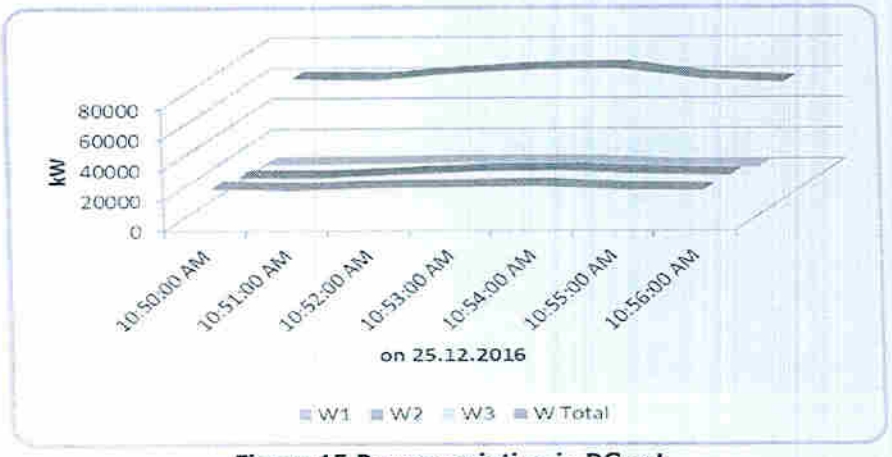


Figure 15 Power variation in DG set

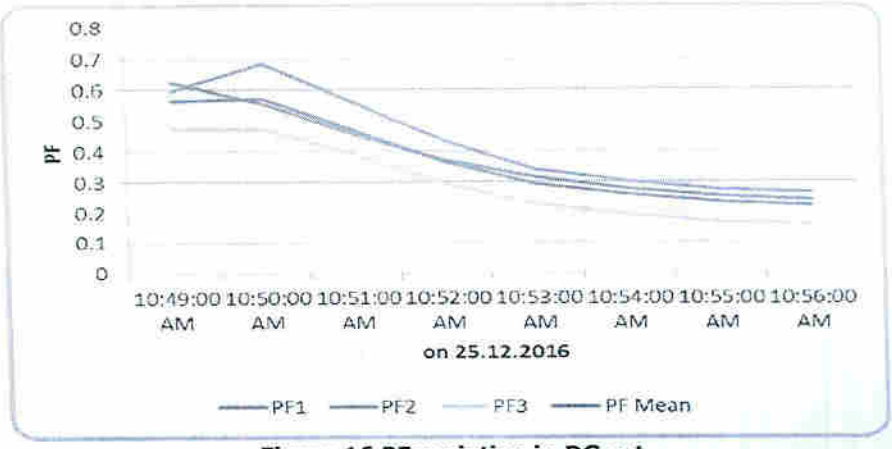


Figure 16 PF variation in DG set

➢ **Energy Saving Measures for DG Set:-**

- The basis for an apprehension that the DG set may get over loaded due to the fact that the current delivered by the DG set is generally considered as the indicator of output by most DG set users. It is well known that use of capacitors will reduce the current drawn from the DG set and could thus tempt the user to add more loads on a given DG set. The other reason for such an opinion is related to the risks arising due to sustained leading power factor conditions that would occur with the use of fixed capacitors in variable load situations. The ill effects of leading power factor on the behaviour of the DG sets are well recognized.
- Ensure steady load conditions on the DG Set , and provide cold dust free air at intake (use of air washers for large sets, in case of dry, hot weather can be considered)
- Improve air filtration.
- Ensure fuel oil storage, handling and preparation as per manufacturers guidelines.
- Consider fuel oil additives in case they benefit fuel oil properties for DG set usage.
- Calibrate fuel injection pump frequently.
- Ensure compliance with maintenance check list.
- In terms of fuel cost economy consider partial use of biomass gas for generation ensure tar removal from the gas for improving availability of the engine in the long run.

3.7 Pump, Fan and Blower

3.7.1 Installation, operation and performance details of Pumping system

Pumps at Adani House are installed at various locations such as Sewage Treatment plant, Pump house and Fire pump house. Details of these pumps are mentioned in below tables:

Table 21 Pumping system details of Adani House STP

Particulars	Unit	filter pump-1	Irrigation pump	sewage feed pump B	Raw sewage water pump
Make		KIRLOSKAR	NA	KIRLOSKAR	LUBI
Rated Flow	m^3/hr	28.8	NA	10.44	10
Rated Head	m	25	NA	11.5	24
Line Size	inch	3	3	3	3

Pump purpose		supply from filter tank to sand filter & carbon filter	supply treated water for gardening	supply from collection tank to aeration tank	supply raw sewage water to collection tank
Connected Motor	kW	3.7	12.5	0.75	NA
Measured Operating Flow	m^3/hr	14.79	47	16.6	35.8
Fluid density	kg/m^3	1000	1000	1000	1000
Discharge Pressure	kg/cm^2	2.1	NA	NA	0.7
Suction Pressure	kg/cm^2	0.1	0.05	0.1	0.1
Operating Head	m	20.0	NA	NA	6.0
Hydraulic Power	kW	0.81	NA	NA	0.59
Rated Motor Efficiency	%	85	NA	75	89
Measured Motor Input Power	kW	3.4	15.1	0.56	2.89
Pump Input power	kW	2.9	0.0	0.4	2.6
Pump Efficiency	%	**27.9**	**NA**	**NA**	**22.8**
Overall Efficiency	**%**	**23.7**	**NA**	**NA**	**20.3**
Running Hr.	hr/day	20	16	20	15
Suction Valve Position	% Open	100	100	100	100
Discharge Valve Position	% Open	100	100	100	100

Observations

- Operating efficiency of irrigation pump and sewage feed pump B cannot be calculated as the operating head could not be measured.
- Operating efficiency of filter pump 1 and raw sewage water pump was calculated and is 23.7 % and 20.3 % respectively, based on measurements at the time of audit. The performance of the pumps is poor.
- It is observed that designed motor efficiency of the pumps was less as per IE3 standard.
- It is proposed to install VFD to Irrigation pump and operate pump in feedback control mode with pressure and flow Requirement. Based on actual pressure demand the pump speed would be modulated and saving achieved in pumping power.
- Estimated savings are to the tune of say **4.24 KWH**.
- After Reducing Pump Frequency with VFD, it shall be saving of **Rs. 0.81 Lacs/Annum** with improving pump performance also with estimated investment of around **Rs.0.80 Lacs** with simple payback of **12 months**.

Table 22 Energy Saving by Installation VFD in Irrigation Pump motor

Sr. No.	Description	Unit	Irrigation pump
1	Rated power	Kw	15
3	Measured Power	Kw	15.1
4	Opt. Hr/day	hr/day	8
5	Motor Efficiency	%	85
6	Pump Head	mtr.	44.4

7	Existing Flow	m^3/hr	47
8	Efficiency of pump	%	43.9
9	Unit cost	Rs./Kwh	7.40
10	Annual opt. day	day	350
11	Proposed efficiency of pump %	%	43.9
12	Proposed Head	mtr.	35
13	Proposed Flow	m^3/hr	50
14	Estimated power	Kw	10.86
15	Power Saving	KWH	4.24
16	Annual saving possible	Rs.	87850
17	Investment Reducing head by reducing frequency with VFD	Rs.	80000
18	Simple payback period	months	12

Table 23 Pumping system details of Adani House Pump House

Particulars	Unit	At pump house Raw water supply pump 2	At pump house Raw water supply pump 1	Pump 3 raw water supply	Pump 4 raw water supply to PUB & CMS gate
Make		LUBI	LUBI	NA	NA
Rated Flow	m^3/hr	32	32	NA	NA
Rated Head	m	42	42	NA	NA
Line Size	inch	4	4	NA	NA
Pump purpose		Raw water supply to Adani house and PUB	Raw water supply to Adani house and PUB	Supply raw water to irrigation tank	
Connected Motor	kW	5.5	5.5	5.5	
Measured Operating Flow	m^3/hr	22	34	30	25.00
Fluid density	kg/m^3	1000	1000	1000	1000
Discharge Pressure	kg/cm^2	3.5	5.6	0.6	NA
Suction Pressure	kg/cm^2	0.2	0.2	NA	NA
Operating Head	m	33.0	54.0	6.0	NA
Hydraulic Power	kW	1.98	5.00	0.49	NA
Rated Motor Efficiency	%	88	88	90	89
Measured Motor Input Power	kW	5.94	8.04	4.79	9.88
Pump Input power	kW	5.2	7.1	4.3	8.8
Pump Efficiency	%	**37.8**	**70.7**	**11.4**	**NA**
Overall Efficiency	%	33.3	62.2	10.2	NA
Running Hr.	hr/day	15	15	NA	NA
Suction Valve Position	% Open	100	100	100	100
Discharge Valve Position	% Open	100	100	100	100

Observations

- Operating efficiency of raw water supply pump 2 and pump 3 is 33.3% and 10.2 % which quite poor.
- Efficiency of pump 4 could not be calculated due to lack of measurement possibility of operating head.
- Pump House Raw water supply pump Installed with PID based system with One no. of VFD, it maintain 3.5 kg pressure and reducing pump RPM up to 2050 after it will goes under off condition, hence it is recommended that Existing pump is replaced with small capacity of pump (3.3 kW) or Continuous running with Reduced Frequency
- Estimated savings are to the tune of say 5.17 **KWH.**
- After Reducing Pump Frequency with VFD, it shall be saving of **Rs. 0.75 Lacs/Annum** with improving pump performance also without any estimated investment with Immediate payback

Table 24 Energy Saving by setting VFD in Raw House Pump 1 & 2 motor

Sr. No.	Description	Unit	At pump house Raw water supply pump 2	At pump house Raw water supply pump 1
1	Rated HP	HP	10	10
2	Rated Kw	Kw	7.5	7.5
3	Measured Power	Kw	5.94	8.04
4	Opt. Hr/day	hr/day	6	6
5	Motor Efficiency	%	88	88
6	Pump Head	mtr.	33	54
7	Existing Flow	m3/hr	22	34
8	Efficiency of pump	%	37.8	64.2
9	Unit cost	Rs./Kwh	7.4	7.4
10	Annual opt. day	Day	350	350
11	efficiency of pump %	%	37.8	64.2
12	Proposed Head	mtr.	35	35
13	Proposed Flow	m3/hr	22	22
14	Estimated power	Kw	5.54	3.27
15	Power Saving	KWH	0.40	4.77
16	Annual saving possible	Rs.	6160	74130
17	Reduce VFD Freq. and running continuous	Rs.	Nil	Nil
18	Simple payback period	Months	Immediately	

Table 25 Pumping system details of Adani House Fire Pump

Particulars	Unit	Electric pump	Jockey pump
Make		KIRLOSKAR	NA
Rated Flow	m^3/hr	96	NA
Rated Head	m	70	NA
Line Size	inch	6	6

Pump purpose		NA	Fire extinguishing and safety
Connected Motor	kW	30	11
Measured Operating Flow	m^3/hr	22	20.6
Fluid density	kg/m^3	1000	1000
Discharge Pressure	kg/cm^2	8.5	6.6
Suction Pressure	kg/cm^2	-0.1	-0.1
Operating Head	m	86.0	67.0
Hydraulic Power	kW	5.16	3.76
Rated Motor Efficiency	%	91	87
Measured Motor Input Power	kW	18	14
Pump Input power	kW	9.0	12.2
Pump Efficiency	%	57.3	30.9
Overall Efficiency	%	28.6	26.9
Running Hr.	hr/day	NA	NA
Suction Valve Position	% Open	100	100
Discharge Valve Position	% Open	30	40

Observations

- Discharge valve of electric pump and jockey pump was open only 30-40 %. Since jockey pump is an emergency pump, it's on field trials were taken by valve throttling because it could not be operated at rated flow for more than 1 minute.

3.8 Package Air Conditioners (PAC)

3.8.1 Installation, operation and performance details of PAC system

There are 4 nos. of Emerson make Package AC Installed in Adani House at different Location, Installation, operation and performance details of PAC system are Described below:

Sr. No.	Parameters	Unit	Adani house	Adani house PAC 1	Adani house PAC 2	Adani house PAC 3
1	Location	PAC	Ground floor, Electric room	1st floor Server room	1st floor Server room	1st floor Server room
2	Type		Down flow	Down flow	Down flow	Down flow
3	Make		Emerson pex 125	Emerson pex 125	Emerson pex 125	Emerson pex 120
4	model		Pex 125 FA-100	Pex 125 FA-100	Pex 125 FA-100	Pex 120 FA-I com
Measurement At Indoor Units:						
5	Suction Area Of The AHU	m^2	0.5625	0.5625	0.5625	0.5625
6	Average Suction Velocity At AHU	m/sec	2.8	2.9	3	2.3
7	Density Of Air	Kg/m^3	1.164	1.184	1.184	1.184
8	Volume Of Air Actually Sucked By the AHU	m^3	5670	5872.5	6075	4657.5
9	Mass Of Air At Inlet	Kg/hr	6599.88	6953.04	7192.8	5514.48
10	Damper Position	%				
Suction Air Data At Inlet To AHU						
11	Air Inlet Temperature (DBT)	°C	30	24.5	22.5	22.5
12	Air Inlet Temperature (WBT)	°C	18	17	15	17
13	Inlet Air Enthalphy	Kcal/Kg	11.98	11.32	9.95	11.34
14	Relative Humidity At Inlet	%	29.66	47.06	44.56	57.88

Sr. No.	Parameters	Unit	Adani house	Adani house PAC 1	Adani house PAC 2	Adani house PAC 3
15	Moisture Content At Inlet	Kg/Kg of Air	0.009	0.009	0.0075	0.0098
16	Total water Content at Inlet	Kg	59.40	62.57736	53.946	54.041904
17	Total Enthalphy At Inlet Air	Kcal	79066.6	78708.4128	71568.36	62534.2032
	Discharge Air data At Ducts:					
18	Air Outlet Temperature (DBT)	°C	24	21.7	21.9	20
19	Air Outlet Temperature (WBT)	°C	16	17	14	14.4
20	Outlet Air Enthalpy	Kcal/Kg	10.9	9.96	9.3	9.61
21	Relative Humidity At Outlet	%	46	48.9	41.16	55
22	Moisture Content At Outlet	Kg/Kg of Air	0.0085	0.00789	0.0067	0.0079
23	Total water Content at Outlet	Kg	56.099	54.859	48.192	43.564
24	Total Enthalpy At Outlet Air	Kcal	71938.7	69252.3	66893.0	52994.2
	Actual Performance:					
26	Enthalpy Removed From Air	Kcal	7127.87	9456.13	4675.32	9540.05
27	Total water Evaporated	Kgs	3.30	7.7179	5.7542	10.4775
28	Enthalpy Of water Evaporation	Kcal	1778.67	4159.93	3101.54	5647.38
29	Total Heat Removed	Kcal	8906.54	13616.07	7776.86	15187.43
30	Actual Capacity	TR	2.95	12.1		
31	Actual Power Measured	KW	11.7	8.7	9.14	8.97
32	Specific Power Consumption (SPC)	KW/TR	3.97	2.22		
33	Running Hr.		24 hours/day	24 hours/day	24 hours/day	24 hours/day
35	Observations		False ceiling found broken, sunlight enters through window	Surrounding Glass wall	Surrounding Glass wall	Surrounding Glass wall

Table 26 Saving in PAC by overhauling with repairing damage false ceiling and window curtain

Sr. No.	Description	Unit	Ground floor, Electric room	1st floor Server room, PAC 2
1	PAC Rated Power Consumption	KW		
3	Measured PAC Power Consumption	KW	11.7	9.14
4	Operating Hours	HR/DAY	6	6
5	Annual Operating Day	Day	360	360
6	Unit cost	Rs./KWH	7.4	7.4
8	Present average specific power consumption	KW/TR	3.97	3.55
9	Proposed Specific power cons.	KW/TR	2.5	2.5
10	Saving in KW	KW	4.3	2.7
11	Saving in Electricity KWH/Annum	KWH	9367	5839
12	Annual saving possible	Rs.	69316	43209
13	Estimated Investment for overhauling, damage false ceiling and window curtain	Rs.	60000	25000
14	Simple payback period	Months	11	7

UPS room Besides Electrical room, Ground Floor, Adani House, False ceiling & Window broken

3.8.2 Installation, operation, performance and recommendations details of VRV system

3.8.3 Installation Details of VRV Indoor and Outdoor Units

Building has 8 nos. VRV system installed, VRV out door unit's installations details describe below table,

Table 27 VRV System Outdoor Unit Installations Details

System No.	HP x Nos.	Total HP	KW x Nos.	Total Cooling Load KW
System 1	18 x 3	54	21 x 3	63
System 2	18 x 3	54	21 x 3	63
System 3	18 x 3	54	21 x 3	63
System 4	18 x 2	36	21 x 2	42
	10 x 1	10	12 x 1	12
System 5	18 x 3	54	21 x 3	63
System 6	18 x 3	54	21 x 3	63
System 7	18 x 3	54	21 x 3	63
System 8	18 x 3	54	21 x 3	63
Total		**424**		**495**
Total Installed TR				**350.4**

3.8.4 VRV system indoor units Ductable/Split AC installations details

Table 28 Ductable and Hiwall Units Installation Details

Rated TR	Unit Type	Total Qty.	Total TR
8.33	Ductable	26	217
6.6	Ductable	11	73
4.13	Ductable	13	54
3.33	Ductable	4	13
1.67	Ductable	9	15
2.1	Ductable	5	11
2.66	Ductable	1	3
2.1	Hiwall	5	11
2.13	Hiwall	2	4
1.67	Hiwall	6	10
1.33	Hiwall	17	23
Total		**99**	**432**

3.8.5 Operation Details

Hiwall and Ductable units running as per requirement of the occupancy movement.

Hiwall and Ductable Units Performance Details

We have performance testing of some Hiwall and Ductable units at Adani house. VRV system wise performance details describe below,

Table 29 VRV System-1 Ductable and Split Units Performance

Sr. No.	Unit	1	2	3	4	5	6	7	8
Adani Sheet Sr. No.							27	28	
VRV System No.		1	1	1	1	1	1	1	1
Floor		2	2	2	2	2	3	3	3
Indoor Unit ID									
RHS/LHS		LHS	LHS	LHS	LHS	LHS	LHS	LHS	LHS
Indoor Name		Open Office	Open Office	Passage-1	Conference Room	Conference Room	Open Office	Open Office	Open Office
Type		FCU	FCU	FCU	Split	Split	FCU	FCU	FCU
FCU/Split Rated TR	TR	8.33	8.33	8.33	1.67	1.67	4.13	8.33	8.33
Room Set Temp.	°C	27	27	27	16	25	26	26	26
Suction Area	m2	0.328	0.328	0.328	0.059	0.059	0.289	0.328	0.328
Velocity	m/s	2.79	6.14	4.06	3.56	3.71	3.7	5.01	5.82
Return Air Temp.	DB (°C)	26	26	26	25	25	25.5	26	26
	WB (°C)	17.5	17.5	17.5	16.5	16.5	17.5	17	17
Enthalpy of Return Air	KJ/KG	48.83	48.83	48.83	45.83	45.83	48.85	47.28	47.28
Supply Air Temp.	DB (°C)	24	23.5	25.5	13	24	23.5	24.5	23.5
	WB (°C)	16	16	16.5	11.5	16	16	16	16.5
Enthalpy of Supply Air	KJ/KG	44.4	44.43	45.8	32.78	44.4	44.43	45.86	45.91
Air Flow	CFM	1938	4259	2816	444	463	2265	3478	4040
Cooling Load	TR	1.38	3.02	1.38	0.93	0.11	1.61	0.80	0.89
Fan Power Cons.	kW	1.12	1.45	1.18	0.018	0.018	1.24	1.32	1.35
Room Area	m2	32.12							
Actual TR/m2	TR/m2	0.032							
As Per Rated TR/m2	TR/m2	0.052							
VRV System Power	KW	7.19							
SPC	KW/TR	1.47							
Air Changes per Hour		17							
Observations		Low Speed Running					Low Speed Running		

Table 30 VRV System-2 Ductable and Split Units Performance

Sr. No.	Unit	9	10	11	12	13	14	15	16
Adani Sheet Sr. No.		24							
VRV System No.		2	2	2	2	2	2	2	2
Floor		1	2	2	3	3	4	4	4

Sr. No.	Unit	9	10	11	12	13	14	15	16
Indoor Unit ID		2:2-06							
RHS/LHS		LHS	LHS	LHS	LHS	LHS	LHS	LHS	LHS
Indoor Name		Meeting Room-1,2,3	Open office & Pantry	Open office & Pantry	Passage	Open Office	Passage	Waiting Room/Reception	Dining Room
Type		FCU	FCU	FCU	FCU Slim	FCU	FCU Slim	FCU	FCU
FCU/Split Rated TR	TR	8.3	4.13	4.13	1.67	4.13	24	8.33	3.33
Room Set Temp.	°C	26	27	27	23	26	24	26	26
Suction Area	m2	0.31	0.289	0.289	0.16	0.289	0.16	0.289	0.238
Velocity	m/s	6.45	3.52	3.78	1.52	5.31	1.44	2.86	2.97
Return Air Temp.	DB (°C)	26.5	25.5	25.5	25.5	26	24	26	26
	WB (°C)	17	16.5	16.5	16.5	17	18	17.5	18
Enthalpy of Return Air	KJ/KG	47.52	45.8	45.8	45.8	47.28	50.52	48.83	50.4
Supply Air Temp.	DB (°C)	24	20.5	20.5	13.5	24.5	22	21	21
	WB (°C)	15	15.5	15.5	11.5	16	14	14.5	13.5
Enthalpy of Supply Air	KJ/KG	41.77	43.1	43.1	32.76	44.37	38.85	40.28	37.56
Air Flow	CFM	4260	2156	2312	511	3252	485	1749	1495
Cooling Load	TR	3.95	0.92	1.01	1.07	1.53	0.91	2.41	3.10
Fan Power Cons.	kW	1.2	0.84	0.89	0.23	0.98	0.27	1.29	0.34
Room Area	m2	84.41						92.13	22.58
Actual TR/m2	TR/m2	0.047						0.026	0.137
As Per Rated TR/m2	TR/m2	0.098						0.090	0.147
VRV System Power	KW	15.97							
SPC	KW/TR	1.48							
Air Changes per hour		31						12	40
Observations					Low Speed Running			Low Speed Running	

Table 31 VRV System-3 Ductable and Split Units Performance

Sr. No.	Unit	17	18	19
Adani Sheet Sr. No.		36	35	37
VRV System No.		3	3	3
Floor		1	1	1
Indoor Unit ID		2:2-08	2:2-07	2:2-10
RHS/LHS		LHS	LHS	LHS
Indoor Name		Exibition-1	Training Hall	Auditorium
Type		FCU	FCU	FCU
FCU/Split Rated TR	TR	8.33	8.33	6.6

Sr. No.	Unit	17	18	19
Room Set Temp.	°C	25	27	25
Suction Area	m2	0.322	0.322	0.322
Velocity	m/s	6.05	6.33	5.29
Return Air Temp.	DB (°C)	25.5	27	25
	WB (°C)	16	17.5	16
Enthalpy of Return Air	KJ/KG	44.32	48.77	44.35
Supply Air Temp.	DB (°C)	15	21	23
	WB (°C)	11.5	15.5	15
Enthalpy of Supply Air	KJ/KG	32.69	43.11	41.58
Air Flow	CFM	4128	4318	3609
Cooling Load	TR	7.74	3.94	1.61
Fan Power Cons.	kW	1.37	1.26	0.95
Room Area	m2		92	130
Actual TR/m2	TR/m2		0.043	0.020
As Per Rated TR/m2	TR/m2		0.091	0.102
VRV System Power	KW	15.56		
SPC	KW/TR	1.44		
Air Changes per hour			28	34

Table 32 VRV System-4 Ductable and Split Units Performance

Sr. No.	Unit	20	21	22	23	24	25
Adani Sheet Sr. No.		44	45	42	43		
VRV System No.		4	4	4	4	4	4
Floor		1	1	G	G	G	G
Indoor Unit ID		02:02:05	2:2-09	2:1-09	2:1-10		
RHS/LHS		LHS	LHS	LHS	LHS	LHS	LHS
Indoor Name		Reception	Exibition-2 (Opp. Auditorium)	Canteen	Canteen	Canteen	Canteen
Type		FCU	FCU	FCU	FCU	FCU	FCU
FCU/Split Rated TR	TR	4.13	8.33	6.6	6.6	6.6	6.6
Room Set Temp.	°C	20	25	26	26	26	26
Suction Area	m2	0.15	0.328	0.328	0.328	0.328	0.328
Velocity	m/s	4.77	4.19	5.08	5.14	5.23	5.26
Return Air Temp.	DB (°C)	25	25	26	26	26	26
	WB (°C)	15.5	16.5	17.5	17.5	17.5	17.5
Enthalpy of Return Air	KJ/KG	42.89	45.83	48.83	48.83	48.83	48.83
Supply Air Temp.	DB (°C)	21.5	20	22.5	23	23.5	22
	WB (°C)	14.5	14	16.5	16.5	16	15.5
Enthalpy of Supply Air	KJ/KG	40.25	38.96	45.97	45.94	44.43	43.06
Air Flow	CFM	1513	2908	3526	3568	3633	3648

Sr. No.	Unit	20	21	22	23	24	25
Cooling Load	TR	0.64	3.22	1.63	1.66	2.58	3.39
Fan Power Cons.	kW	0.75	1.23	1.39	1.28	1.3	1.25
VRV System Power	KW	12.15					
SPC	KW/TR	1.47					

Table 33 VRV System-5 Ductable and Split Units Performance

Sr. No.	Unit	26	27	28	29
Adani Sheet Sr. No.					
VRV System No.		5	5	5	5
Floor		4	4	4	4
Indoor Unit ID					
RHS/LHS		RHS	RHS	RHS	RHS
Indoor Name		Passage	Board Room	Board Room	Executive Dining Hall
Type		FCU	FCU	FCU	FCU
FCU/Split Rated TR	TR	1.67	8.33	8.33	3.33
Room Set Temp.	°C	23	26	26	25
Suction Area	m2	0.16	0.289	0.289	0.289
Velocity	m/s	2.43	5.80	5.24	2.41
Return Air Temp.	DB (°C)	25.5	25	25	25.5
	WB (°C)	19.5	18	18	18
Enthalpy of Return Air	KJ/KG	55.34	50.46	50.46	50.43
Supply Air Temp.	DB (°C)	20.5	17	16	22
	WB (°C)	15.5	13	12.5	15.5
Enthalpy of Supply Air	KJ/KG	43.14	36.43	35.17	43.06
Air Flow	CFM	834	3551	3208	1477
Cooling Load	TR	1.64	8.03	7.91	1.76
Fan Power Cons.	kW	0.56	1.42	1.4	0.54
Room Area	m2		177		23.04
Actual TR/m2	TR/m2		0.090		0.076
As Per Rated TR/m2	TR/m2		0.094		0.145
VRV System Power	KW	22.37			
SPC	KW/TR	1.36			
Air Changes per hour			13		39

Table 34 VRV System-6 Ductable and Split Units Performance

Sr. No.	Unit	30	31	32	33	34	35	36	37	38	39
Adani Sheet Sr. No.						56	57		62	58	59
VRV System No.		6	6	6	6	6	6	6	6	6	6
Floor		2	2	2	2	3	3	3	3	3	3
Indoor Unit ID						1:3-03	1:3-04		1:3-09	1:2-06	1:2-07
RHS/LHS		RHS	RHS	RHS	RHS	RHS	RHS	RHS	RHS	RHS	RHS
Indoor Name		Open Office	Open Office	Open Office	Passage	Open Office	Open Office	Open Office	Server Room	Conference Room	Conference Room

Sr. No.	Unit	30	31	32	33	34	35	36	37	38	39
Type		FCU	FCU	FCU	FCU Slim	FCU	FCU	FCU	FCU	Split	Split
FCU/Split Rated TR	TR	8.33	8.33	4.13	1.67	8.33	8.33	4.13	4.13	1.33	1.33
Room Set Temp.	°C	26	26	26	24	27	27	27	26	23	23
Suction Area	m2	0.28	0.28	0.289	0.22	0.28	0.28	0.29	0.26	0.056	0.056
Velocity	m/s	6.29	5.67	3.48	3.04	4.55	5.06	3.29	2.70	2.61	3.18
Return Air Temp.	DB (°C)	25.5	25.5	25.5	24.5	26	26	26	26	23	23
	WB (°C)	16.5	16.5	16.5	17	17	17	17	17	13	14
Enthalpy of Return Air	KJ/KG	45.8	45.8	45.8	47.35	47.28	47.28	47.28	47.28	36.13	38.8
Supply Air Temp.	DB (°C)	24.5	24.5	21.5	21.5	18	19	21.5	21.5	12	12
	WB (°C)	16	16	15.5	15	13	14	15.5	15.5	7	7.5
Enthalpy of Supply Air	KJ/KG	44.36	44.36	43.08	41.65	36.38	39.01	43.08	43.08	22.45	23.52
Air Flow	CFM	3706	3340	2130	1428	2707	3008	2012	1510	310	378
Cooling Load	TR	0.86	0.78	0.93	1.31	4.76	4.01	1.36	1.02	0.68	0.93
Fan Power Cons.	kW	1.4	1.38	0.94	0.59	0.57	1.25	0.98	1.06	0.0165	0.023
Room Area	m2								44.83	22.88	
Actual TR/m2	TR/m2								0.023	0.071	
As Per Rated TR/m2	TR/m2								0.092	0.116	
VRV System Power	KW	15.94									
SPC	KW/TR	1.45									
Air Changes Per Hour Observations						Low Speed Running			20	18	Low Speed Running

Table 35 VRV System-7 Ductable and Split Units Performance

Sr. No.	Unit	40	41	42	43	44	45	46	47	48
Adani Sheet Sr. No.		73							74	75
VRV System No.		7	7	7	7	7	7	7	7	7
Floor		1	1	1	1	1	1	1	2	2
Indoor Unit ID		1:2-02							1:2-04	1:2-05
RHS/LHS		RHS	RHS	RHS	RHS	RHS	RHS	RHS	RHS	RHS
Indoor Name		Reception	Reception	Open Cabin (Above Pantry)	Open Cabin (Above Pantry)	Open office	Open office	Open office	Meeting Room-1	Meeting Room-2
Type		FCU	FCU	FCU	FCU	FCU	FCU	FCU	Split	Split
FCU/Split Rated TR	TR	4.33	8.33	6.66	6.66	8.33	8.33	8.33	1.33	1.33
Room Set Temp.	°C	20	20	26	26	27	27	27	28	29
Suction Area	m2	0.24	0.328	0.328	0.328	0.328	0.328	0.328	0.059	0.059
Velocity	m/s	3.74	6.47	2.38	3.77	3.65	6.47	5.975	3.00	3.07
Return Air Temp.	DB (°C)	25	24	25.5	25	26.5	25.5	25.5	24	24

Sr. No.	Unit	40	41	42	43	44	45	46	47	48
	WB (°C)	16	15	16.5	16	16	16.5	16.5	16.5	16.5
Enthalpy of Return Air	KJ/KG	45.83	41.52	45.8	45.83	44.26	45.8	45.8	45.89	45.89
Supply Air Temp.	DB (°C)	19.5	17	21	22	23	23	22.5	16	15
	WB (°C)	13	12	14	15.5	15.5	15	15	12	11
Enthalpy of Supply Air	KJ/KG	36.31	33.85	38.9	43.06	43	41.58	41.6	33.9	31.45
Air Flow	CFM	1874	4492	1654	2615	2534	4489	4148	374	383
Cooling Load	TR	2.88	5.56	1.84	1.17	0.51	3.05	2.81	0.72	0.89
Fan Power Cons.	kW	0.69	1.1	1.18	1.15	1.08	1.37	1.41	0.012	0.013
Room Area	m2								22.88	
Actual TR/m2	TR/m2								0.071	
As Per Rated TR/m2	TR/m2								0.116	
VRV System Power	KW	19.38								
SPC	KW/TR	1.41								
Air Changes per Hour									20	
Observations				Low Speed Running						

Table 36 VRV System-8 Ductable and Split Units Performance

Sr. No.	Unit	49	50
Adani Sheet Sr. No.		87	88
VRV System No.		8	8
Floor		1	1
Indoor Unit ID			
RHS/LHS		RHS	RHS
Indoor Name		Open Office	Open Office
Type		FCU	FCU
FCU/Split Rated TR	TR	8.33	8.33
Room Set Temp.	°C	26	26
Suction Area	m2	0.328	0.328
Velocity	m/s	5.81	6.96
Return Air Temp.	DB (°C)	25	25
	WB (°C)	16.5	16.5
Enthalpy of Return Air	KJ/KG	45.83	45.83
Supply Air Temp.	DB (°C)	22	21.5
	WB (°C)	15	15.5
Enthalpy of Supply Air	KJ/KG	41.63	43.08
Air Flow	CFM	4034	4835
Cooling Load	TR	2.73	2.14
Fan Power Cons.	kW	1.12	1.14

Sr. No.	Unit	49	50
Room Area	m2		
Actual TR/m2	TR/m2		
As Per Rated TR/m2	TR/m2		
VRV System Power	KW	5.15	
SPC	KW/TR	1.52	

3.8.6 Observations Serial Number wise (Sr. No. Mention in Above table 1st Raw)

Table 37 Observations and Recommendations

Unit No. in Above Tables	Observations & Recommendations
1/2/10	▪ Problem found in sr. no. 1 AC controller. ▪ No return duct installed ▪ Sun film not installed at window glass but outside glass frame installed ▪ Entrance door permanent open found, we suggest installed air curtain ▪ Window curtain installed
6/7/8	▪ No return duct found ▪ Office Entrance door open found, we suggest installed air curtain ▪ Window curtain installed found ▪ Sun film installed at outside frame glass ▪ Cabin-3 & 4 installed split ACs due to less man power movement
9	▪ All Meeting room are separate for cooling only 1 Ductable AC installed ▪ No Return Duct found ▪ Return Air Mixing with fresh air from foyer ▪ Blue sun film installed at window glass ▪ At non used meeting room if anyone but AC is continues working condition found
15	▪ No return duct installed
16	▪ Dining hall ACs on condition found in no occupancy movement, If possible split ACs installed at dining hall.
17/21	▪ Fresh air taken from Exhibition area ▪ Blue sun film not installed at window glass ▪ This AC running in function time ▪ Window curtain installed
18	▪ Fresh air taken from Exhibition area ▪ No return duct installed ▪ Blue sun film installed at window glass ▪ This AC running in training time ▪ Window curtain installed
19	▪ Fresh air taken from Exhibition area ▪ No return duct installed ▪ This AC running in function time
20	▪ Fresh air taken from foyer ▪ Blue sun film not installed at front glass ▪ This AC running in function time
22/23/24/25	▪ Sun film not available in west side window ▪ West side window curtain available but present open condition found ▪ Entrance door open found, we suggest installed air curtain
27/28/29	▪ Board Room and Executive dining hall ACs on condition found in no occupancy movement, If possible split ACs installed at dining hall.
30/31/32	▪ No return duct found

	▪ Office Entrance door open found, we suggest installed air curtain ▪ Window curtain installed found ▪ Sr. no. 31 AC controller not working at beside AC. ▪ Sun film installed at outside frame glass ▪ It recommended to operate AC as per occupancy and switch off at place of empty area. ▪ Office LHS side window curtain is open found ▪ Pantry duct is continuing open found but present no man power sitting at this area, closed the duct permanent
34/35/36	▪ No return duct found ▪ Sr. no. 34 AC abnormal sound found ▪ Window curtain installed found ▪ Sun film installed at outside frame glass ▪ Office Entrance door open found, we suggest installed air curtain
38	▪ This ACs not working properly, not cooling found, checked it
40	▪ Fresh air taken from foyer ▪ Blue sun film not installed at front glass ▪ This AC running in function time
41	▪ Fresh air taken from foyer ▪ Blue sun film not installed at front glass ▪ This AC running in function time
42/43/44/45/ 46/49/50	▪ All ACs is running found. ▪ No return duct found ▪ Office Entrance door open found, we suggest installed air curtain ▪ Window curtain installed found ▪ Sun film not installed at window glass, we have suggested installed sun film ▪ At the time field studies cabin-1 & cabin-2 less occupancy movement found but ACs will be running, we suggest installed individual split AC in cabin-1/2/3

Recommendations

- **Energy Saving in blower power by reducing air changes rate**

Following common Air Change Rates per hour for buildings / rooms and human comfort;

-	All spaces in general min	4
-	Offices	10-12
-	Auditoriums	8 - 15
-	Department Stores	6 - 10
-	Dining Halls	12 -15
-	Dining rooms (restaurants)	12
-	Cafeterias	12 - 15
-	Computer Rooms	15 - 20
-	Lunch Rooms	12 -15
-	Theatres	8 - 15
-	Waiting rooms, public	4

See below table for required and proposed air changes rates

Table 38 Air Changes Rate Table

Adani Sheet Sr. No.	VRV System No.	Floor	Indoor Unit ID	RHS /LHS	Indoor Name	Type	FCU/Split Rated TR	Air Flow (CFM)	Cooling Load (TR)	Room Area	Actual TR/m2	As Per Rated TR/m2	Air Changes per hour	Required Air Changes	Observations
42	4	G	2:1-09	LHS	Canteen	FCU	6.6	3526	1.626	296.4	0.031	0.089	16	12-15	Normal Reduce Air Changes
43	4	G	2:1-10	LHS	Canteen	FCU	6.6	3568	1.663						
	4	G		LHS	Canteen	FCU	6.6	3633	2.577						
	4	G		LHS	Canteen	FCU	6.6	3648	3.394						
	7	1		RHS	Open Cabin (Above Pantry)	FCU	6.66	1654	1.84	537	0.030	0.102	24	10-12	Reduce Air Changes
	7	1		RHS	Open Cabin (Above Pantry)	FCU	6.66	2615	1.17						
87	8	1		RHS	Open Office	FCU	8.33	4034	2.73						
88	8	1		RHS	Open Office	FCU	8.33	4835	2.14						
	7	1		RHS	Open Office	FCU	8.33	4356	2.28						
	7	1		RHS	Open Office	FCU	8.33	4489	3.05						
	7	1		RHS	Open Office	FCU	8.33	4148	2.81						
	1	2		LHS	Open Office	FCU	8.33	1491	1.07	244.41	0.025	0.102	20	10-12	Reduce Air Changes
	2	2		LHS	Open Office & Pantry	FCU	4.13	2156	0.92						
	1	2		LHS	Open Office	FCU	8.33	4259	3.02						
	2	2		LHS	Open Office	FCU	4.13	2312	1.02						
	6	2		RHS	Open Office	FCU	8.33	3706	0.86	198.24	0.013	0.105	22	10-12	Reduce Air Changes
	6	2		RHS	Open Office	FCU	8.33	3340	0.78						
	6	2		RHS	Open Office	FCU	4.13	2130	0.93						
27	2	3		LHS	Open Office	FCU	4.13	2256	1.61	244.41	0.016	0.102	23	10-12	Reduce Air Changes
28	1	3		LHS	Open Office	FCU	8.33	3148	0.72						
	1	3		LHS	Open Office	FCU	8.33	3818	0.84						
	2	3		LHS	Open Office	FCU	4.13	2189	0.69						
56	6	3		RHS	Open Office	FCU	8.33	2707	4.76	198.24	0.051	0.105	19	10-12	Reduce Air Changes
57	6	3		RHS	Open Office	FCU	8.33	3008	4.01						
	6	3		RHS	Open Office	FCU	4.13	2012	1.36						

- **Installation of Return Air Duct**

Provision of Return duct for Ductable System of Open office area

- Existing return are through common false celling area between Ductable Room and Area
- Due that Additional Load approximately 15 to 18 % has been added in actual requirement of HVAC System
- Appropriate size of Return Air duct required which is to be connected with Ductable units Inlet with provision of Fresh Air duct with damper on both return air as well as fresh air duct
- Fresh air damper and return air damper open/close position to be set accordingly temperature of Return air temperature and fresh air temperature

Table 39 Saving with Installation of Return air Duct

Location	Air Flow (CFM)	Present TR Generation	Room Volume Ratio	% Reduction in Required Air Flow (CFM)	CFM/ KW	CFM/ TR	Increase in Heat Load due to increase in Return Air temp	Equivalent Power (kW)	Reduction Power due to reduction of false celling area (kW)	Reduction Heat Load (TR)	Equivalent Reduction in VRV Power (kW)	Total Reduction in Power (kW)	Annual Working Hour	Annual Saving
1st Floor RHS Open Office	26131	16.02	24	5911	566	594	1.57	1.64	10.44	9.95	10.44	19.25	1440	190667
2nd Floor LHS Open Office	10218	5.59	24	2311	488	513	0.61	0.64	4.73	4.51	4.73	8.83	1440	87451
2nd Floor RHS Open Office	9176	2.36	24	2092	525	552	0.55	0.58	3.98	3.79	3.98	7.39	1440	73191
3rd Floor LHS Open Office	11411	3.86	24	2602	545	572	0.68	0.72	4.77	4.55	4.77	8.83	1440	87475
3rd Floor RHS Open Office	7727	10.00	24	1762	442	465	0.46	0.48	3.98	3.79	3.98	7.48	1440	74092

Location	Air Flow (CFM)	Present TR Generation	Room Volume Ratio	% Reduction in Required Air Flow (CFM)	CFM/ KW	CFM/ TR	Increase in Heat Load due to increase in Return Air temp	Equivalent Power (kW)	Reduction Power due to reduction of false celling area (kW)	Reduction Heat Load (TR)	Equivalent Reduction in VRV Power (kW)	Total Reduction in Power (kW)	Annual Working Hour	Annual Saving
4th Floor LHS Reception	1749	2.41	24	399	250	262	0.10	0.11	1.60	1.52	1.60	3.08	1440	30524
Total														543400/-

General Observation and Recommendations

Figure 1. **VRV Gas line**

Figure 2. **VRV System 2 & 4 Outdoor units Coil damage found**

Figure 3 **VRV System 5 & 6 Outdoor units Chocked and Coil Damage Found**

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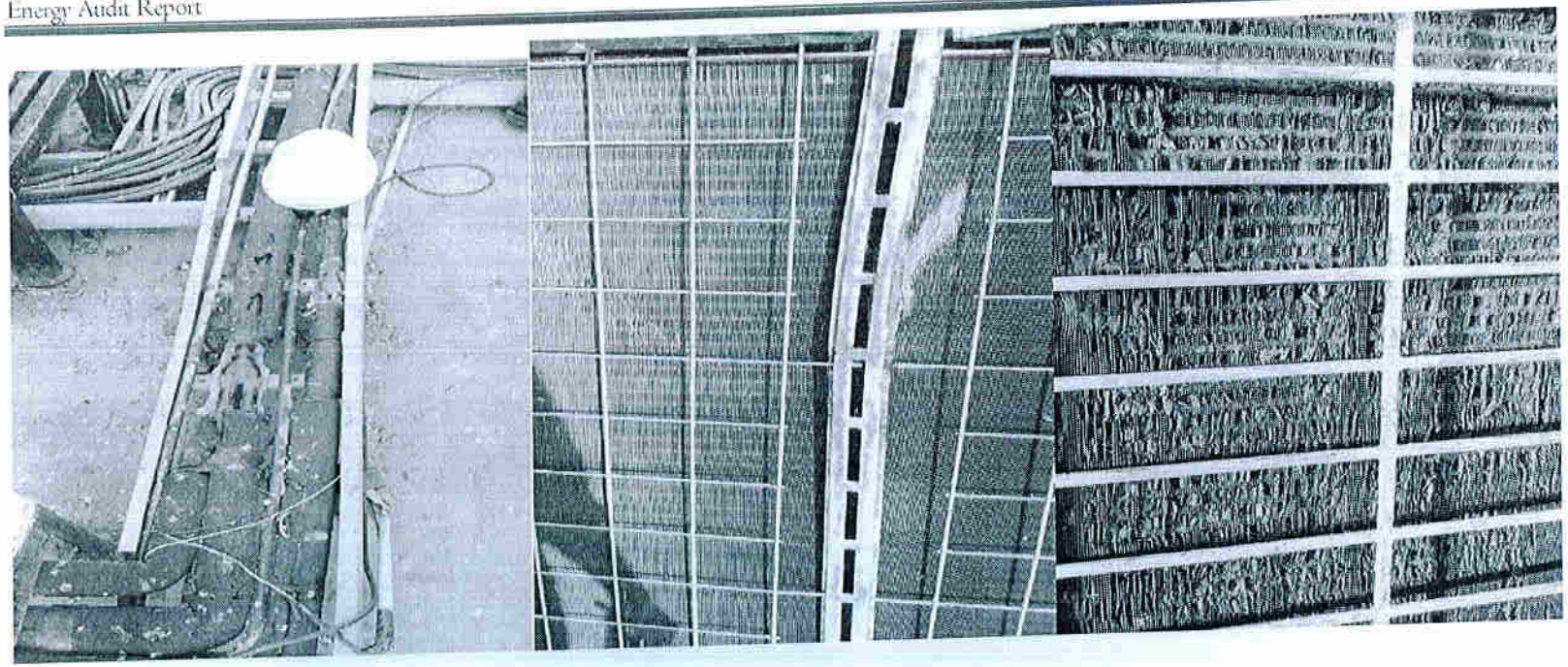


3.9 LIGHTING SYSTEM

3.9.1 Lux measurement of different Indoor fittings

Based on different type of fixtures in Adani House power measurement was taken from which calculation of power consumed/ fixture is calculated. Average lux of minimum 6 points to maximum of 16 points as per area has been taken in the calculation.

Table 40 Power Consumption study of different luminary

Location	Sub location	Luminary	Fixtures Turn on	Rated Power / Luminary (W)	Measured on DB Power (W)	Measured Power/ luminary	Average Lux at working plane
Ground Floor	Reception and corridor	CFL warm white	16	18	298	18.625	192
First Floor	Staff room LHS	LED Ceiling Tile	28	36	1024	36.569	284
Ground Floor	Staff office	FTL	24	36	890	37.083	303
Ground Floor	Bridge light Foyer	T-5	9	40	368	40.889	210

3.9.2 Lighting Installation details of small areas

Office areas, rest lounge, cafeteria and meeting rooms are considered as small areas where lighting installations are fitted. Installation details of these areas are mentioned in table below:

Table 41 Indoor lighting installation and measurement details

Sr. No.	Area	Sub Area	Type of Luminary	Fixtures On	Total fixtures	Net Watt/Luminary	Reflector Y/N	Natural Lighting Avalability	Possibility of Natural Lighting	Choke/Ignitor Type Copper/Al./Ballast	Power Mention DB No. & Any Remarks	Fixtures/ switch
1	Gnd floor	BMS room	CFL	3	6	18	Y	No	No	Ballast	LDB 101	3
2	Gnd floor	IT office	LED	6	6	32	N	No	No		LDB 101	2
3	Gnd floor	Server Room	FTL	4	8	36	Y	No	No	Choke	LDB 101	4
4	Gnd floor	CMR	CFL	5	5	18	Y	No	No	Ballast	LDB 101	2,3
5	Gnd floor	CMR office	CFL	4	4	18	Y	Yes	Yes	Ballast	LDB 101	2
6	Gnd floor	Wash room RHS	CFL	0	6	18	Y	No	No	Ballast	LDB 101	2

Sr. No.	Area	Sub Area	Type of Luminary	Fixtures On	Total fixtures	Net Watt/Luminary	Reflector Y/N	Natural Lighting Avalability	Possibility of Natural Lighting	Choke/Ignitor Type Copper/Al./Ballast	Power Mention DB No. & Any Remarks	Fixtures/ switch
7	Gnd floor	Cafeteria	CFL	4	10	18	Y	No	No	Ballast	LDB 101	2,3
8	Gnd floor	compactor Room	CFL	8	24	24	Y	No	No	Ballast	LDB 101	8
9	Gnd floor	Electrical Room	FTL	8	8	36	Y	No	No	Choke	LDB 101	4
10	Gnd floor	RHS Cabin 1	FTL	2	2	36	Y	No	No	Choke	LDB 101	2
11	Gnd floor	RHS Cabin 2	FTL	2	2	36	Y	No	No	Choke	LDB 101	2
12	Gnd floor	RHS Cabin 3	FTL	2	2	36	Y	No	No	Choke	LDB 101	2
13	Gnd floor	RHS Cabin 4	FTL	2	2	36	Y	No	No	Choke	LDB 101	2
14	1st Floor	Meeting 2	CFL	8	8	18	Y	No	No	Ballast	LDB 202	4
15	1st Floor	Meeting 3	CFL	4	4	18	Y	No	No	Ballast	LDB 202	2
16	1st Floor	Meeting 1	CFL	16	16	18	Y	Yes	No	Ballast	LDB 202	4
17	1st Floor	Exhibition Foyer	CFL	30	30	18	Y	Yes	Yes	Ballast	LDB 202	10
18	1st Floor	Café	CFL	6	6	18	Y	Yes	Yes	Ballast	LDB 202	1
19	1st Floor	Server Room	FTL	12	12	36	Y	Yes	Yes	choke	LDB 201	3
20	1st Floor	IT office	CFL	16	16	36	Y	No	No	Ballast	LDB 201	4
21	1st Floor	LAN room	CFL	4	4	18	Y	No	No	Ballast	LDB 201	2
22	1st Floor	CSR	FTL	16	16	36	Y	No	No	Choke	LDB 201	4
23	1st Floor	Cabin 1	T-5	2	2	40	Y	Yes	Yes	Choke	LDB 201	1
24	1st Floor	cabin 2	T-5	3	4	40	Y	No	No	Ballast	LDB 201	1
25	1st Floor	Cabin 3	T-5	2	2	40	Y	No	No	Ballast	LDB 201	1
26	1st Floor	Cabin 4	CFL	4	4	18	Y	No	No	Ballast	LDB 201	2
27	2nd Floor	RHS Cabin 2 AGM Office	T-5	2	2	40	Y	Yes	Yes	Choke	LDB 301	1
28	2nd Floor	RHS Cabin 1	T-5	2	2	40	Y	Yes	Yes	Choke	LDB 301	1
29	2nd Floor	Conference Room RHS	CFL	2	18	18	Y	Yes	No	Ballast	LDB 301	6

Sr. No.	Area	Sub Area	Type of Luminary	Fixtures On	Total fixtures	Net Watt/Luminary	Reflector Y/N	Natural Lighting Avalability	Possibility of Natural Lighting	Choke/Ignitor Type Copper/Al./Ballast	Power Mention DB No. & Any Remarks	Fixtures/ switch
30	2nd Floor	Coffee lounge RHS	CFL	3	12	18	Y	Yes	Yes	Ballast	LDB 301	2
31	2nd Floor	Reception RHS	LED	6	6	30	N	No	No	NA	LDB 302	2
32	2nd Floor	Passage RHS	LED	8	8	11	N	No	No	Ballast	LDB 301	8
33	2nd Floor	Passage LHS	LED	10	10	11	N	No	No	Ballast	LDB 302	5
34	2nd Floor	Cubicle 4 RHS	CFL	8	8	18	Y	Yes	Yes	Ballast	LDB 301	4
35	2nd Floor	Cubicle 3 RHS	T-5	1	1	40	Y	Yes	Yes	Choke	LDB 301	1
36	2nd Floor	Cubicle 1	LED	6	6	11	N	Yes	Yes	NA	LDB 301	3
37	2nd Floor	Cabin 1 GM office RHS	T-5	2	2	40	Y	Yes	Yes	Choke	LDB 302	1
38	2nd Floor	Cabin 2 office LHS	T-5	2	2	40	Y	Yes	Yes	Choke	LDB 302	1
39	2nd Floor	Coffee lounge LHS	CFL	12	12	18	Y	Yes	No	Ballast	LDB 302	3
40	2nd Floor	Meeting 2 LHS	CFL	12	12	18	Y	Yes	No	Ballast	LDB 302	4
41	2nd Floor	Meeting 1 LHS	CFL	12	12	18	Y	Yes	No	Ballast	LDB 302	4
42	3rd Floor	Cubicle 4 RHS	FTL	2	2	36	Y	Yes	No	Choke	LDB 401	1
43	3rd Floor	Cubicle 3 RHS	FTL +CFL	1+1	2	36+18	Y	Yes	No	Choke + Ballast	LDB 401	1
44	3rd Floor	Cubicle 2 RHS	FTL +CFL	1+1	2	36+18	Y	Yes	No	Choke + Ballast	LDB 401	1
45	3rd Floor	Cubicle 1 RHS	FTL +CFL	2+2	4	36+18	Y	Yes	No	Choke + Ballast	LDB 401	1,3
46	3rd Floor	Cabin 1 RHS	FTL	2	2	36	Y	Yes	Yes	Choke	LDB 401	2
47	3rd Floor	Cabin 2 RHS	FTL	1	1	36	Y	Yes	Yes	Choke	LDB 401	1
48	3rd Floor	Coffee lounge LHS	CFL	12	12	18	Y	Yes	No	Ballast	LDB 402	2
49	3rd Floor	Cubicle 3 LHS	LED+ CFL	3	1+2	36+18	Y	Yes	Yes	Ballast	LDB 402	1,2
50	3rd Floor	Cubicle 2 LHS	LED+ CFL	3	1+2	36+18	Y	Yes	Yes	Ballast	LDB 402	1,2
51	3rd Floor	Cubicle 1 LHS	FTL	2	2	36	Y	Yes	Yes	Choke	LDB 402	2

Sr. No.	Area	Sub Area	Type of Luminary	Fixtures On	Total fixtures	Net Watt/Luminary	Reflector Y/N	Natural Lighting Avalability	Possibility of Natural Lighting	Choke/Ignitor Type Copper/Al./Ballast	Power Mention DB No. & Any Remarks	Fixtures/ switch
52	3rd Floor	Cubicle 4 LHS	FTL	2	2	36	Y	Yes	Yes	Choke	LDB 402	2
53	3rd Floor	Cabin 1 LHS	FTL	2	2	36	Y	Yes	Yes	Choke	LDB 402	2
54	3rd Floor	Cabin 2 LHS	FTL	2	2	36	Y	Yes	Yes	Choke	LDB 402	2
55	3rd Floor	Meeting 1 LHS	CFL	3	3	18	Y	Yes	No	Ballast	LDB 402	3
56	3rd Floor	Meeting 2 LHS	CFL	3	3	18	Y	Yes	No	Ballast	LDB 402	3
57	4th Floor	Conference Room LHS	CFL	9	9	18	Y	Yes	No	Ballast	LDB 502	9
58	4th Floor	Reception LHS	CFL	6	6	18	Y	Yes	No	Ballast	LDB 502	3
59	4th Floor	Director Office LHS	CFL	18	18	18	Y	Yes	No	Ballast	LDB 502	9

3.9.3 Calculations and observations for lighting fixtures in small areas

Observations regarding the working conditions during the time of audit has been compiled into below table:

Table 42 Lighting in small areas calculation and observation

Sr. No.	Area	Sub Area	Measu. Condition with or w/o lighting	Lumens Measurement	Running Hours (Hr/day)	Remarks	Room Length (m)	Room Breadth (m)	Room Height (m) (Mounting)	Room Index (RI)	Target lux Index	Installed Light Efficacy Ratio (ILER)	Performance Indicator
1	Gnd floor	BMS room	With	73	24	UT	4.15	3.25	2.9	0.63	30.00	0.608	Review suggested
2	Gnd floor	IT office	With	289	24	UT	4.85	5.7	2.9	0.90	43.00	0.968	Satisfactory
3	Gnd floor	Server Room	With	160	24	UT	3.2	2.4	3.1	0.44	30.00	0.284	Urgent Action required
4	Gnd floor	CMR	With	75		NOR	3.9	3	2.9	0.58			
5	Gnd floor	CMR office	w/o		9	NLA	3.9	3	2.9	0.58	36.00		
6	Gnd floor	Wash room RHS	With	89	NA	OC	3.9	3.9	2.9	0.67	36.00		
7	Gnd floor	Cafeteria	With	114			4.8	3.9	2.6	0.83	36.00	0.823	Satisfactory
8	Gnd floor	compactor Room	With	373	NA	NOR	4.85	4.15	2.9	0.77	36.00	1.086	Satisfactory

Sr. No.	Area	Sub Area	Measu. Condition with or w/o lighting	Lumens Measurement	Running Hours (Hr/day)	Remarks	Room Length (m)	Room Breadth (m)	Room Height (m) (Mounting)	Room Index (RI)	Target lux Index	Installed Light Efficacy Ratio (ILER)	Performance Indicator
9	Gnd floor	Electrical Room	With	274	9		9.8	5.7	2.9	1.24	36.00	1.476	Satisfactory
10	Gnd floor	RHS Cabin 1	With	271	NA	VAC	3.9	3	2.9	0.58			
11	Gnd floor	RHS Cabin 2	With	265	NA	VAC	3.9	3	2.9	0.58			
12	Gnd floor	RHS Cabin 3	With	204	NA	VAC	3.9	3	2.9	0.58			
13	Gnd floor	RHS Cabin 4	With	317	NA	VAC	3.9	3	2.9	0.58			
14	1st Floor	Meeting 2	With	139	NA	VAC	3.9	3	2.9	0.58			
15	1st Floor	Meeting 3	With	135	NA	VAC	3.9	3	2.9	0.58			
16	1st Floor	Meeting 1	With	110	NA	NBU	4.85	5.7	2.9	0.90	36.00	0.293	
17	1st Floor	Exhibition Foyer	With	189	6	NLA, SF	12.8	8.7	3.1	1.67	43.00	0.906	Satisfactory
18	1st Floor	Café	w/o	60		NLA, SF	4.8	3.9	2.9	0.74	36.00		
19	1st Floor	Server Room	w/o	46	24	NLA, SF	4.66	3	2.6	0.70	36.00		
20	1st Floor	IT office	With	463	9	OC	7.27	2.78	2.6	0.77	36.00	0.451	Urgent Action required
21	1st Floor	LAN room	w/o	89		NOR	4.8	3	2.4	0.77	36.00		
22	1st Floor	CSR	With	214		OC, NOR	9.8	5.8	2.4	1.52	43.00	0.491	Urgent Action required
23	1st Floor	Cabin 1	w/o	236	NA	NOR, NAS	3.9	3	2.9	0.58			
24	1st Floor	cabin 2	With	331	NA	NOR	3.9	3	2.9	0.58	36.00	0.896	Satisfactory
25	1st Floor	Cabin 3	With	142	NA	NOR	3.9	3	2.9	0.58	36.00	0.577	Review suggested
26	1st Floor	Cabin 4	With	103	NA	VAC	3.9	3	2.9	0.58			
27	2nd Floor	RHS Cabin 2 AGM Office	With	211	9	SF, NBU	3.5	3.9	2.9	0.64	36.00	1.000	Satisfactory
28	2nd Floor	RHS Cabin 1	w/o	382	9	NAS	3.5	3.9	2.9	0.64	36.00		
29	2nd Floor	Conference Room RHS	With	274	NA	NOR, SF, NBU	4.7	4.9	2.9	0.83			
30	2nd Floor	Coffee lounge RHS	With	620	9	SF, NLA	4.8	4.8	2.6	0.92			

Sr. No.	Area	Sub Area	Measu. Condition with or w/o lighting	Lumens Measurement	Running Hours (Hr/day)	Remarks	Room Length (m)	Room Breadth (m)	Room Height (m) (Mounting)	Room Index (RI)	Target lux Index	Installed Light Efficacy Ratio (ILER)	Performance Indicator
31	2nd Floor	Reception RHS	With	305	4		3.4	5.62	2.9	0.73	36.00	0.899	Satisfactory
32	2nd Floor	Passage RHS	w/o	105	3	NAS	11.7	1.63	2.6	0.55			
33	2nd Floor	Passage LHS	w/o	339	3		11.7	1.63	2.6	0.55			
34	2nd Floor	Cubicle 4 RHS	With	237	9	NAS	3.5	2.1	2.9	0.45	36.00	0.336	Urgent Action required
35	2nd Floor	Cubicle 3 RHS	w/o		2	NLA	3.5	2.1	2.9	0.45	36.00		
36	2nd Floor	Cubicle 1	With	280	9	NAS, SF	3.5	2.1	2.9	0.45	36.00	0.866	Satisfactory
37	2nd Floor	Cabin 1 GM office RHS	w/o	546	9	NLA	3.5	3.9	2.9	0.64	36.00		
38	2nd Floor	Cabin 2 office LHS	With	187	9	NAS, SF	3.5	3.9	2.9	0.64	36.00	0.886	Satisfactory
39	2nd Floor	Coffee lounge LHS	With	330	NA	SF, NAS	4.8	4.8	2.6	0.92	36.00	0.978	Satisfactory
40	2nd Floor	Meeting 2 LHS	With	387	NA	NBU, SF	5.18	3	2.9	0.66	36.00	0.773	Satisfactory
41	2nd Floor	Meeting 1 LHS	With	218	NA	NBU, SF	5.18	3	2.9	0.66	36.00	0.436	Urgent Action required
42	3rd Floor	Cubicle 4 RHS	With	351	9	SF, NAS	3.5	2.1	2.9	0.45	36.00	0.995	Satisfactory
43	3rd Floor	Cubicle 3 RHS	With	397	9	SF, NAS	3.5	2.1	2.9	0.45	36.00		
44	3rd Floor	Cubicle 2 RHS	With	402	9	SF, NAS	3.5	2.1	2.9	0.45	36.00		
45	3rd Floor	Cubicle 1 RHS	w/o	210	NA	VAC	3.5	2.1	2.9	0.45	36.00		
46	3rd Floor	Cabin 1 RHS	w/o	182	9	NLA	3.5	2.1	2.9	0.45	36.00		
47	3rd Floor	Cabin 2 RHS	w/o	124	9	NLA	3.5	2.1	2.9	0.45	36.00		
48	3rd Floor	Coffee lounge LHS	With	324	NA	SF, NAS	4.8	4.8	2.6	0.92	36.00	0.960	Satisfactory
49	3rd Floor	Cubicle 3 LHS	w/o	1102	9	NLA	3.5	2.1	2.9	0.45			
50	3rd Floor	Cubicle 2 LHS	w/o	272	9	NBU	3.5	2.1	2.9	0.45			
51	3rd Floor	Cubicle 1 LHS	with	333	9	NLA	3.5	2.1	2.9	0.45	36.00	0.944	Satisfactory
52	3rd Floor	Cubicle 4 LHS	with	390	9	NLA	3.5	2.1	2.9	0.45	40.00	0.995	Satisfactory

Sr. No.	Area	Sub Area	Measu. Condition with or w/o lighting	Lumens Measurement	Running Hours (Hr/day)	Remarks	Room Length (m)	Room Breadth (m)	Room Height (m) (Mounting)	Room Index (RI)	Target lux Index	Installed Light Efficacy Ratio (ILER)	Performance Indicator
53	3rd Floor	Cabin 1 LHS	w/o	618	9	NLA	3.5	3.9	2.9	0.64			
54	3rd Floor	Cabin 2 LHS	w/o	601	9	NLA	3.5	3.9	2.9	0.64			
55	3rd Floor	Meeting 1 LHS	With	136	NA	NBU	5.18	3	2.9	0.66			
56	3rd Floor	Meeting 2 LHS	With	90	NA	NBU	5.18	3	2.9	0.66			
57	4th Floor	Conference Room LHS	w/o	473	NA	VAC	5.18	7.46	2.9	1.05			
58	4th Floor	Reception LHS	w/o	310	NA	NLA	4.9	4.26	2.9	0.79			
59	4th Floor	Director Office LHS	w/o	360	NA	NLA	4.9	5.5	2.9	0.89			

Table 43 Remarks Legend

Abbreviation	Full Form
NOR	Non occupancy Room
VAC	Room vacant/unused during audit
UT	Utility room, open during non-office hours
NBU	Natural Lighting Available but not utilising, window is curtained
NAS	Natural Lighting Utilising but not sufficient due to sun film
NLA	Natural Lighting Available and utilising
SF	Window in coated with non-reflective sun films
OC	Occupancy sensors installed

3.9.4 Installation and measurement details of large office areas

Office Areas with room size larger than normal were audited for lighting system. The measurement and installation details are mentioned in figures below:

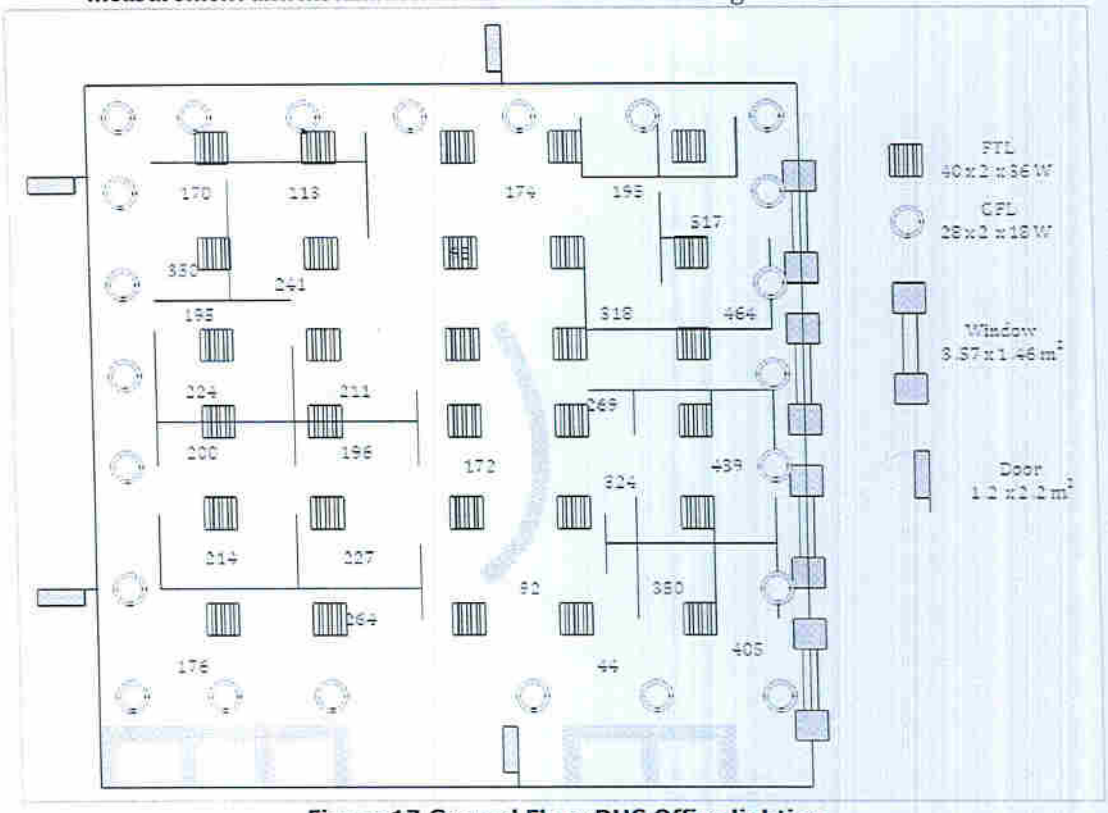


Figure 17 Ground Floor RHS Office lighting

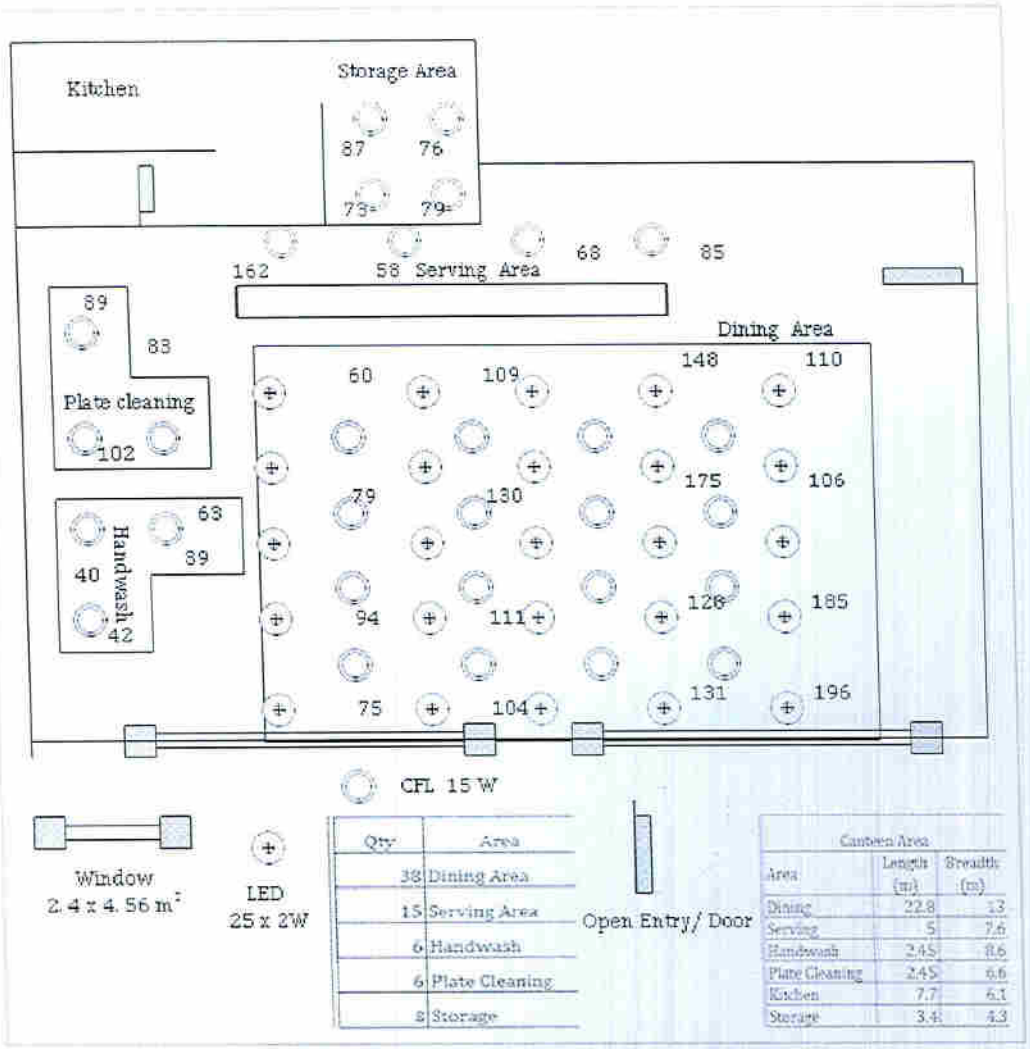


Figure 18 Ground Floor Dining Hall Lighting

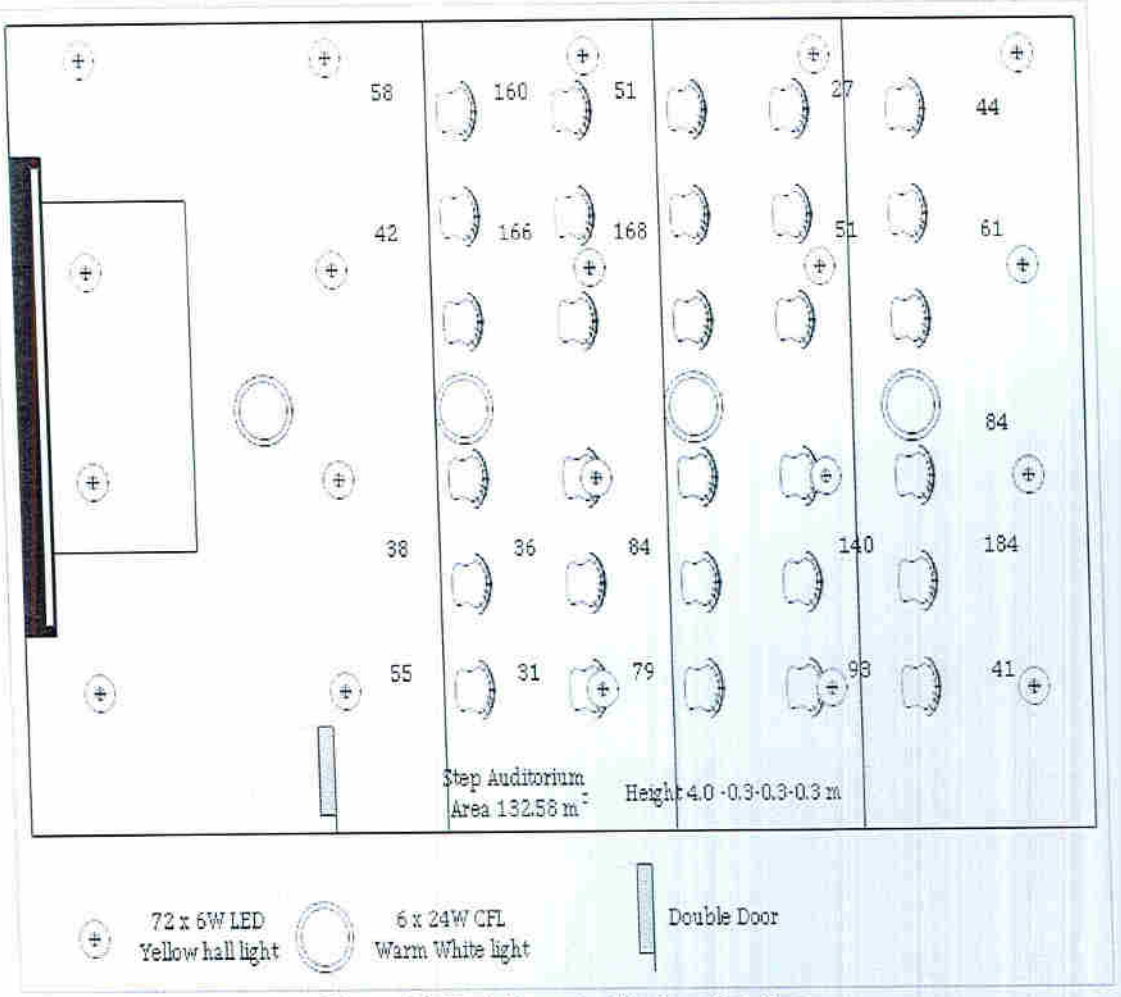


Figure 19 First Floor Auditorium lighting

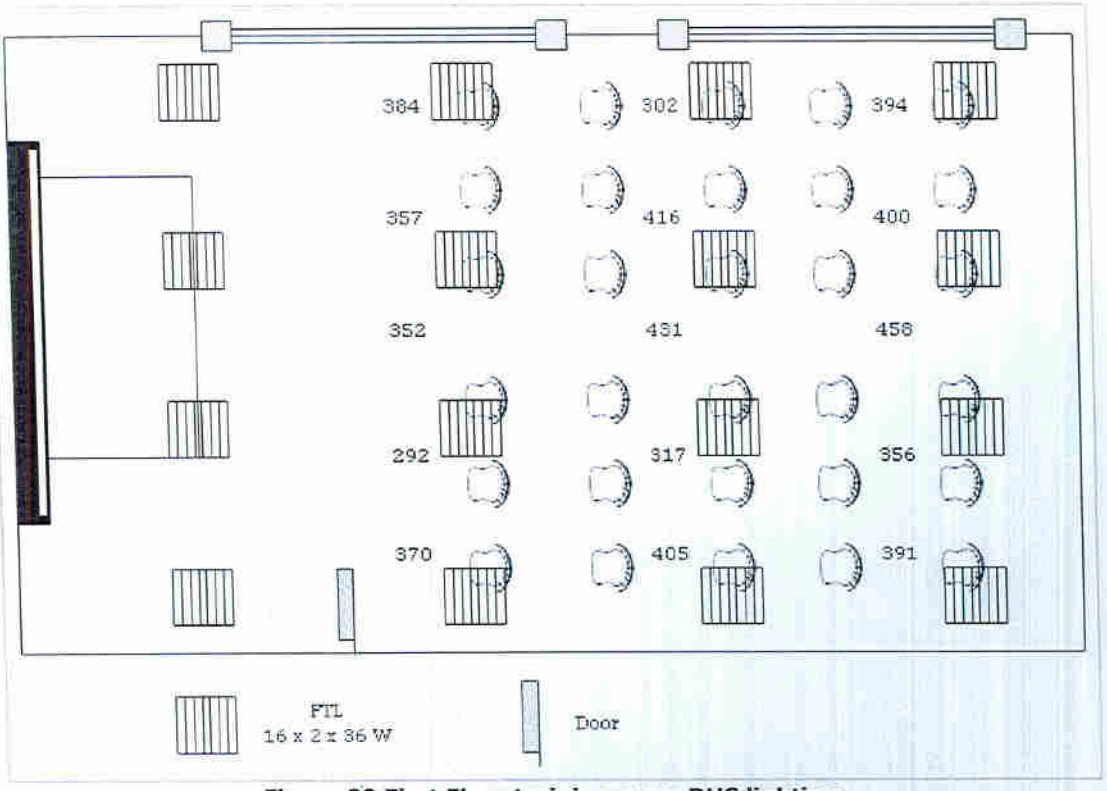


Figure 20 First Floor training room RHS lighting

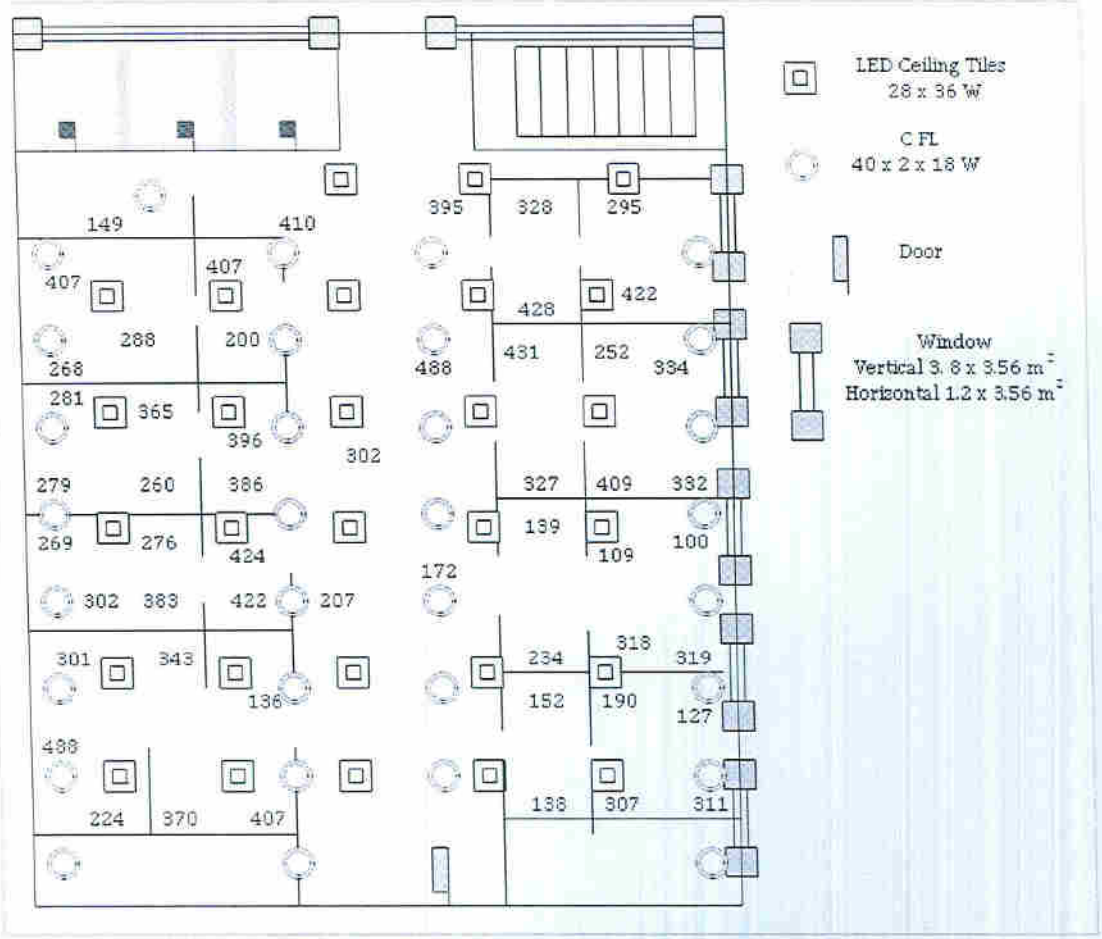


Figure 21 First Floor staff office RHS lighting

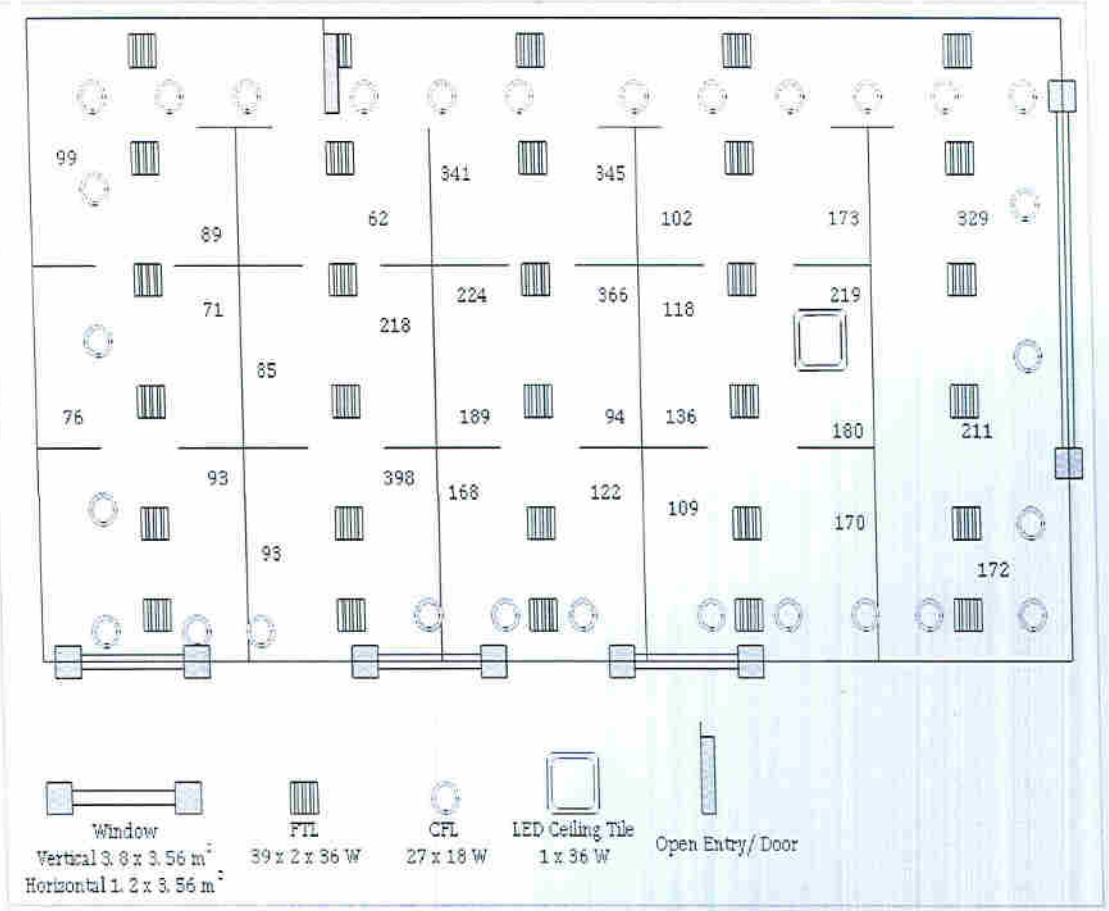


Figure 22 Second Floor LHS staff office lighting

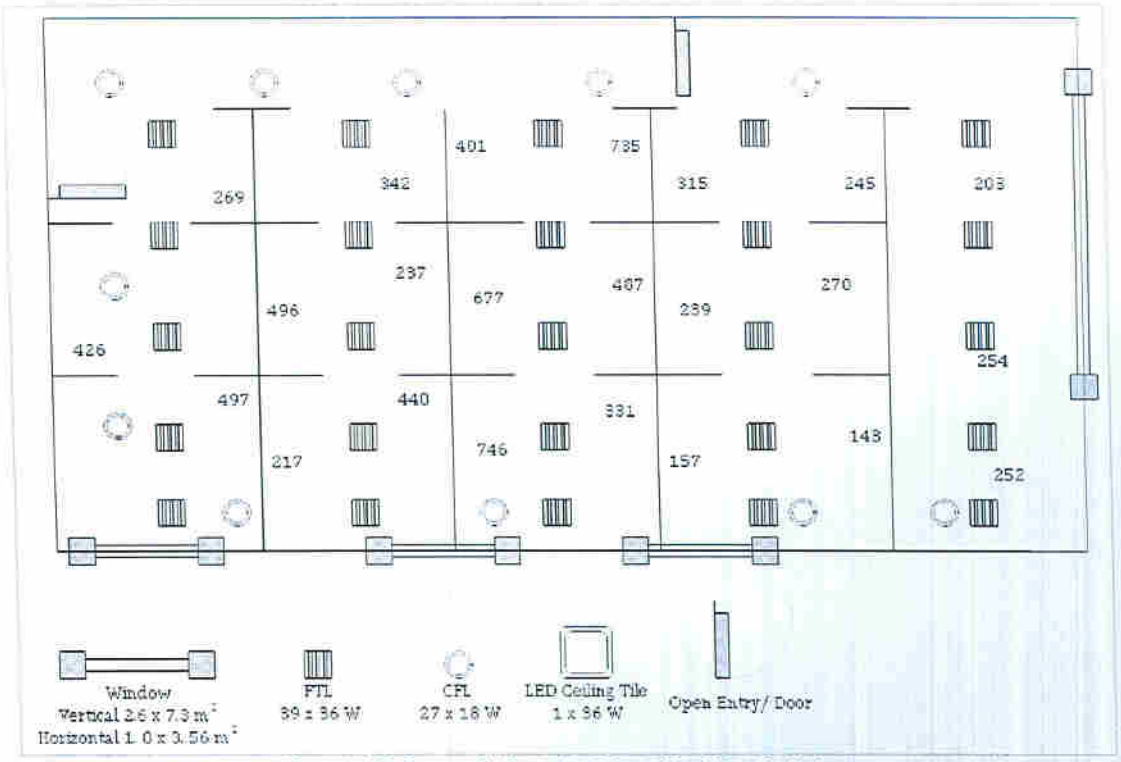


Figure 23 Second Floor RHS staff office lighting

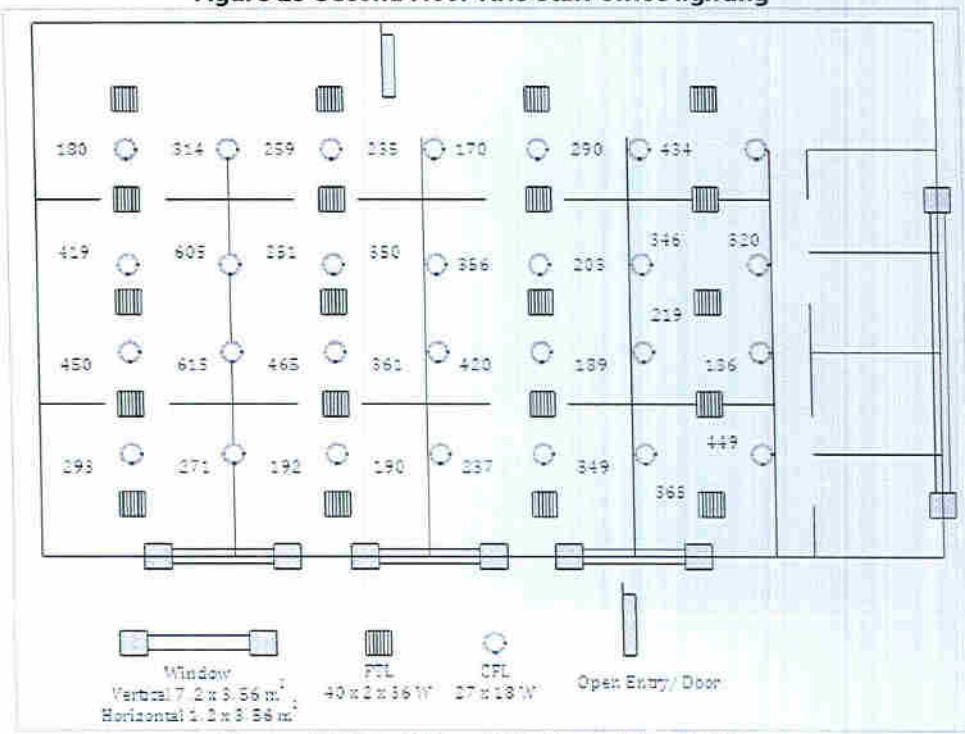


Figure 24 Third Floor LHS staff office lighting

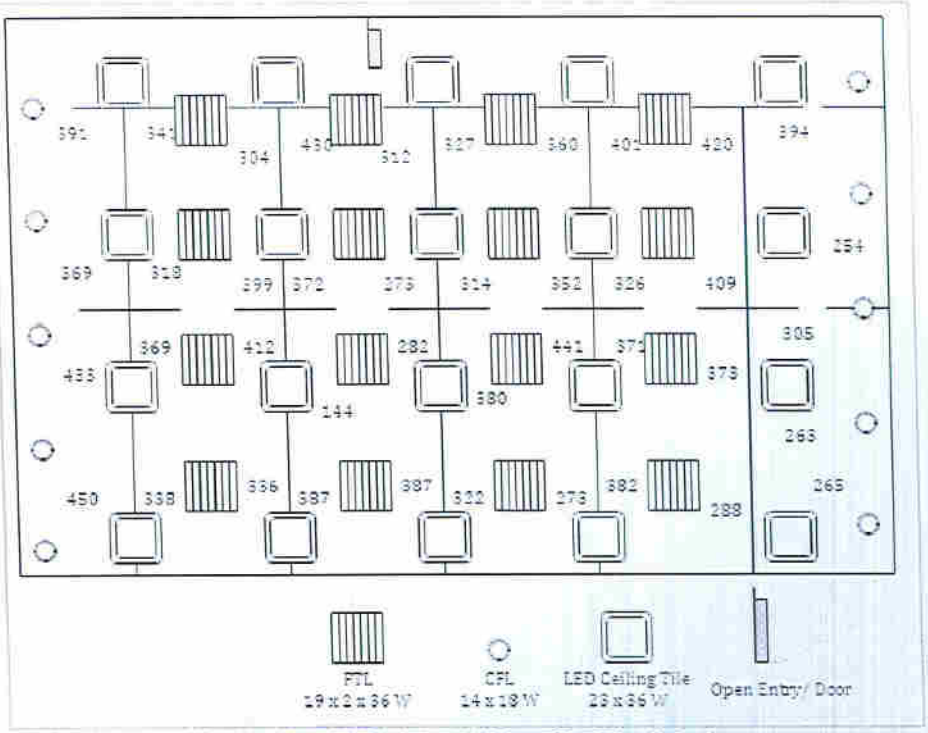


Figure 25 Third Floor RHS staff office lighting

3.9.5 Street lighting

Lux of Streetlights of Adani House and street from Adani House to Ports Utility Buildings (PUB) was measured. Some of the newly fitted streetlight recently before start of audit were anonymous. Audit team has marked names to these poles and their locations are specified in figure below:

Table 44 Adani House to PUB Streetlight measurement

Sr. No.	Location	Pole tag	Height (m)	Span (m)	Luminary	Average Lux	A1	A2	B1	B2	C1	C2	C3	C4	D4	Remark
1	Adani House	AP-01	11.5	Single	LED-2Way	23	30	22	24	19	26	26	12	21	24	
2	Adani House	AP-02	11.5	27	LED-2Way	23	33	18	20	17	28	25	20	20	20	
3	Adani House	AP-03	11.5	27	LED-2Way	21	35	16	20	22	27	22	15	20	17	
4	Adani House	AP-04	11.5	27	LED-2Way	23	34	22	29	20	22	29	18	19	19	
5	Adani House	AP-05	11.5	27	LED-2Way	22	27	21	22	21	26	23	14	17	25	
6	Adani House	AP-06	11.5	27	LED-2Way	21	33	24	24	25	23	25	11	20	15	
7	Adani House	AP-07	11.5	27	LED-2Way	21	29	21	22	17	25	23	19	18	16	
8	PMC building	AP-08	11.5	27	LED-2Way	23	41	20	30	19	22	32	16	22	18	

Sr. No.	Location	Pole tag	Height (m)	Span (m)	Luminary	Average Lux	A1	A2	B1	B2	C1	C2	C3	C4	D4	Remark
9	PMC building	AP-09	11.5	27	LED-2Way	24	62	20	24	22	24	27	15	22	20	
10	PMC building	AP-10	11.5	27	LED-2Way	24	54	26	22	30	21	26	17	20	18	
11	PMC building	AP-11	11.5	22	LED-2Way	26	44	19	31	24	29	31	16	21	24	
12	PMC building	AP-12	11.5	27	LED-2Way	22	31	15	27	17	29	25	10	17	22	
13	PMC building	AP-13	11.5	27	LED	23	31	25	20	22	24	26	17	17	25	
14	PMC building	AP-14	11.5	27	LED	22	33	26	29	17	21	30	11	22	19	
15	PMC building	AP-15	11.5	27	LED	22	33	16	28	25	22	24	12	23	20	
16	PMC building	AP-16	11.5	27	LED	23	45	25	20	21	23	32	13	17	20	
17	PMC building	AP-17	11.5	27	LED	25	40	23	26	19	26	27	20	21	25	
18	Adani House	AP-18	11.5	31	LED	27	24	23	20	21	30	27	23	28	31	
19	Adani House	AP-19	11.5	31	LED											off
20	Adani House	AP-20	11.5	31	LED	27	21	26	24	22	29	24	23	25	31	
21	Adani House	AP-21	11.5	31	LED	29	27	26	24	23	33	30	26	27	33	
22	Adani House	AP-22	11.5	31	LED	26	24	19	17	17	32	27	19	23	32	
23	Adani House	AP-23	11.5	31	LED	25	29	24	20	17	28	22	18	22	30	
24	Adani House	AP-24	11.5	31	LED	26	23	20	18	18	27	26	23	23	31	
25	Adani House	AP-25	11.5	31	LED	26	27	21	19	17	27	23	19	24	33	
26	Adani House	AP-26	11.5	31	LED	26	24	20	18	17	26	24	23	22	33	
27	Adani House	AP-27	11.5	31	LED	23	21	19	19	18	27	27	21	2	32	
28	Adani House	AP-28	11.5	31	LED	27	23	18	20	19	29	26	22	26	35	
29	Adani House	AP-29	11.5	31	LED	25	20	20	18	17	28	28	22	23	29	
30	Adani House	EF-1	6	14	LED	21	34	25	30	17	25	25	11	20	17	
31	Adani House	EF-2	6	14	LED	22	42	24	29	25	20	24	17	22	15	
32	Adani House	EF-3	6	14	LED	22	27	19	29	21	20	28	20	18	18	
33	Adani House	EF-4	6	14	LED	21	46	16	31	17	22	26	14	18	16	
34	Adani House	EF-5	6	14	LED	23	40	17	27	18	28	28	11	19	20	

Sr. No.	Location	Pole tag	Height (m)	Span (m)	Luminary	Average Lux	A1	A2	B1	B2	C1	C2	C3	C4	D4	Remark
35	Adani House	EF-6	6	14	LED	24	47	25	19	17	19	29	14	25	25	
36	Adani House	EF-7	6	14	LED	22	46	17	25	19	24	29	10	21	16	
37	Adani House	EF-8	6	14	LED											off
38	Adani House	ER-1	6	14	LED	25	67	26	46	20	19	34	13	28	12	
39	Adani House	ER-2	6	14	LED	23	62	24	43	1	17	30	12	25	16	
40	Adani House	ER-3	6	14	LED	30	59	32	65	34	40	17	15	26	22	
41	Adani House	ER-4	6	14	LED	19	60	45	28	12	29	4	9	22	4	
42	Adani House	ER-5	6	14	LED	21	62	29	24	11	9	45	11	16	9	
43	Adani House	ER-6	6	14	LED	26	50	22	41	24	15	39	12	36	15	
44	Adani House	ER-7	6	14	LED	26	55	27	24	15	40	43	13	23	14	
45	Adani House	ER-8	6	14	LED	21	54	28	5	6	21	46	11	5	18	

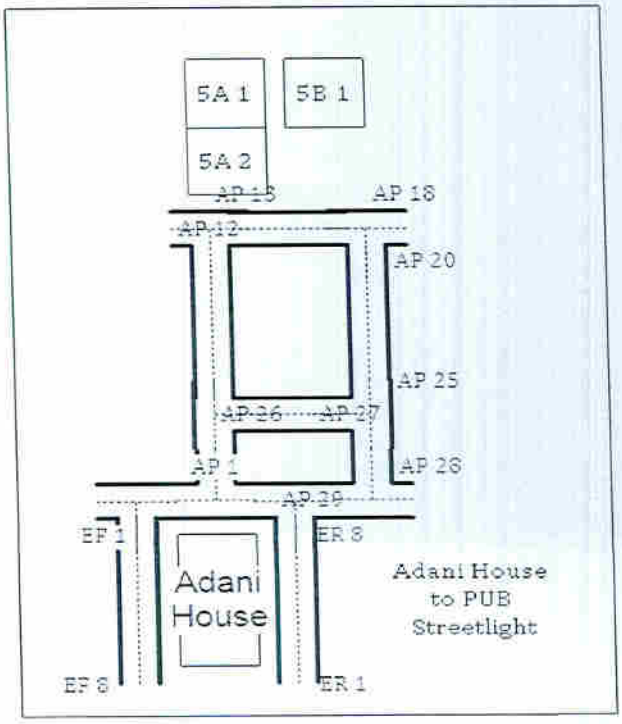


Figure 26 Adani House to PUB Streetlight Pole Arrangement

3.9.6 Lighting Power

- Based on instantaneous power measured during the time of audit at peak occupancy hours the lighting power was measured individual panel wise that is location in ground floor electrical room. The total power calculated is as shown in below table:

Table 45 Lighting power DB wise

Location	Tag	Phase	V	I	kW	PF	Sub subtotal	sub total
Adani House							kW	kW
Ground Floor	LDB101	RN	240	7.7	1.59	0.86	1.95	7.80
		YN	240	2.14	0.36	0.7		
		BN	241	0	0	0		
	LDB102	RN	239	0	0	0	5.85	
		YN	240	8.11	1.93	0.99		
		BN	240	16.5	3.92	-0.99		
First Floor	LDB201	RN	240	4.64	1.07	0.96	4.39	6.04
		YN	241	3.58	0.82	-0.95		
		BN	240	2.5	2.50	0.99		
	LDB202	RN	239	1.23	0.27	-0.93	1.65	
		YN	240	3.79	0.86	0.95		
		BN	239	2.33	0.52	-0.93		
Second Floor	LDB301	RN	241	3.27	0.75	0.96	1.27	2.32
		YN	241	3.64	0.52	0.6		
		BN	240	0	0.00	0		
	LDB302	RN	239	1.14	0.26	0.94	1.05	
		YN	240	1.57	0.37	0.98		
		BN	238	2.68	0.42	-0.96		
Third Floor	LDB401	RN	239	9.03	2.10	0.97	2.69	4.30
		YN	239	3.9	0.59	0.63		
		BN	239	0	0	0		
	LDB402	RN	235	3.33	0.53	0.67	1.62	
		YN	234	3.86	0.54	0.7		
		BN	239	2.34	0.55	-0.98		
Fourth Floor	LDB501	RN	240	2.48	0.41	0.69	0.41	0.41
		YN	240	0	0.0	0		
		BN	240	0	0.0	0		
External Light	DB1	RN	243	2.94	0.524	0.734	2.86	9.001
		YN	242	4.83	1.143	0.977		
		BN	242	5.04	1.188	0.971		
	DB2	RN	244	7.98	1.89	0.97	6.15	
		YN	243	8.64	2.03	0.959		
		BN	241	9.87	2.226	0.934		
Total Power	kW	29.87						

Table 46 Saving with AVC in Lightning power

Sr. No.	Particulars	Values	Unit
1	Measured Lighting load adani House during day time	20.9	kW
	Measured External Lighting load adani House during Night time	9.0	kW
2	Present Average Voltage at Receiving End (V1)	240	V 1-ph
3	Proposed Operating Voltage after Installing AVC (V2)	230	V 1-ph
4	Power (P1)	V^2/R	
5	Power (P2)	$P1(V2/V1)^2$	
	Proposed power for External light	8.3	kW
	Proposed power for day time	19.2	kW
6	Power Savings at Present Lighting Load	2.4	kW
7	Total Annual Operating Time day and night	7200	Hr
8	Total Saving Potential	17549	kW/yr
9	Total Savings Potential	129863	Rs. /yr
10	Investment for transformer tap changing	0	Rs.
11	Simple Payback Period	Immediate	Month

- Based on ILER of observed rooms in Adani House, following rooms have been suggested

Table 47 Energy Saving by replacing energy efficient indoor lighting and improving ILER

Location	ILER	Running Hours	Luminary	Existing power consumption	Action	Potential Power Saving
		Hr.		W		kWh/year
Ground Floor Server room	0.284	8760	FTL	148.332	Replace with single 15 W LED	773.8
Ground floor BMS room	0.608	7200	CFL	55.875	Replace with 10 W LED	186.3
1st Floor IT office	0.451	2700	CFL	298	Replace with 10 W LED	372.6
1st Floor CSR	0.491	8760	FTL	593.328	Replace with 15 W LED	3095.2
2nd Floor Cubicle 4 LHS	0.336	2700	CFL	167.625	Replace with 10 W LED	209.6
Total Power Saving Potential						4637.4
Saving in cost in Rs.						34317
Total 15 W LED Proposed @Rs. 1500						20
Total 10 W LED proposed @Rs. 1000						28
Investment						58000

Location	ILER	Running Hours	Luminary	Existing power consumption	Action	Potential Power Saving
Simple payback in Month						21

- Reverse ceiling lighting termed as bridge light in Adani House consists of 40 W Tubelight
- This light is only for decoration and aesthetic. It can be replaced with LED strips

Table 48 Energy Saving by Replacing reverse lighting tubelights with LED strip

Floor	Grd Floor	1st Floor	2nd Floor	3rd Floor
Fixture	Tubelight			
No of fittings	60	56	72	72
Measured power/ luminary(W)	40.889			
Approximate Running Hours	2			
Estimated annual power consumption (kWh)	2.5	2.3	2.9	2.9
Power through LED strip 5 meter (W)	25			
Estimated annual power consumption (kWh)	0.5	0.45	0.625	0.625
Annual Power saving (kW)	1407	1324	1670	1670
Total Power saving potential (kWh)				6071
Cost saving Rs. @ 7.4 unit rate				44925.4
Investment for LED Strip (5X90) meter				67500
Simple payback in Month				18

- **Intangible Energy conservation Opportunity at Adani House :**

  - **Replacement of Existing ACs with 5-Star Rated ACs**

  - **Replacement of Existing ACs with "7-Star" Natural Refrigerant Rated ACs (R290 Based)**

  - **Replacement with Inverter ACs**

    Digital Inverter technology maintains precise control of room temperature and creates a comfortable environment. In conventional split Air Conditioners, the compressor switches off once the set temperature is reached, and switches on again after temperature drops. The time it takes for the Split Air Conditioner to switch on and off causes the room temperature to greatly fluctuate. With Digital Inverter, the inverter control reduces the compressor power once the desired temperature has been reached, but continues operating at a reduced state to maintain a stable room temperature with minimal fluctuations. By putting an end to on/off compressor operation, the inverter technology also allows Digital Inverter to significantly reduce noise levels; Superior reliability has been achieved, due to the reduction of the compressor ON/OFF cycles. Digital DC Inverter Air Conditioners provide this benefit to consumers, helping them to achieve various benefits such as saving of at least 25% of their energy costs. These air conditioners are much quieter and offer higher levels of efficiency as their noisier counterparts. The average AC power consumption as recorded during winter (present time) is about 54.71 KW. This is likely to be 30 to 35% higher during hot season. The average consumption could be put at 60 KW/month over year. The power savings with digital inverter type AC units would at 20% would be 12 KW/month. The annual energy conservation potential of this intervention is: 94,000 kWh/year.

  - **Incorporating Evaporative Air Cooling**

    Dry Climates are ideally suitable for Evaporative Cooling. Double circuit evaporative cooling would be worth looking into, contingent upon availability of water and space. An evaporative cooler produces effective cooling by combining a natural process - water evaporation - with a simple, reliable air-moving system. Fresh outside air is pulled through moist pads where it is cooled by evaporation and circulated through a house or building by a large blower. As this happens, the temperature of the outside air can be lowered as much as 30 degrees. This technology can provide significant savings relative to conventional electric compressor-based AC systems in areas with low humidity. Furthermore, this system will drastically improve air quality for and occupational health of kitchen and office staff since these systems do not recirculate air unlike Air Conditioning systems. Incidences of building-sickness with these systems will be largely eliminated and will improve overall workforce productivity. Evaporative Cooling comes at 40% lesser cost compared to refrigerant based cooling.

  - **Direct Evaporative Water Spraying Technology**

    This technology essentially comprises of spraying water on exterior building walls to reduce the temperature of the interior environment and thereby reducing Air Conditioning load and increasing operational energy efficiency of the built space. While this system does increase water consumption and the associated energy for pumping, these impacts might be mitigated by utilizing the grey water recycled or stored harvested rain water from the building rooftop during the wet months and putting it to

use in the dry months. This technology is not expected to yield significant benefit in humid climates or seasons. Also, the paint selection for building exteriors must account for the increased fungal growth potential due to increased surface moisture – and hence must have strong anti-fungal properties.

➢ **Overhaul of Refrigerant Piping Insulation & Filter Maintenance**

The Gas pipe insulation was found to be damaged at various points on the AC units. Mending / replacement of insulation would improve the performance of AC units. Cleaning of filters of all indoor units and cleaning of condenser fins by jet pumps. Average life of typical Split Units is considered to be 10 years in dry climates without corrosive pollutants.

➢ **Optimal AC Temperature Setting**

Using all Units at Specific Set Points can greatly reduce HVAC energy consumption. It was observed that the set-point for ACs was generally at 190 C in the Bank Branch. All AC units may be set at 23/24 ^{0}C for optimum power consumption. The annual energy conservation potential of this intervention is: 28,500 kWh/year

➢ **Enhanced Use of Natural Lighting**

- Natural lighting available at the premises through the existing glass facades needs to be exploited to reduce the lighting load exerted. Currently, most of the glass facades are shielded using vertical-blinds and artificial lighting is used even in areas in the vicinity of glass panes.
  This intervention has the twin beneficial impact of reducing manufacturing related LCA impacts of lighting fixtures as well as reduced energy consumption. Some green architecture guidelines specify design lighting loads in the vicinity of 7.5 W/sq.m. For building occupancy of 10 hours/day, the average annual electricity conservation and GHG emissions mitigation per sq. m of naturally lit space relative to conventionally lit space is estimated to be 27 kWh/sq.m and 24 kgCO2e/sq. m.

➢ **Building-Envelope & Air-Conditioned Space Insulation**

- Weather-Stripping of All Doors, especially the main entrance doors into all building cavities.
  Use of Air curtain on Ground Floor Entrance to curtail infiltration losses: Frequenting clients on Ground Floor through main entrance incurs losses due to infiltration. These could be curtailed using Air Curtains. The advantage would be more prominent during summer

➢ **Solar-Hear Gain Reduction**

- Double-Glazed Panes and Spectrally-Selective Window Films
  Double and Triple-Glazed Windows enhance the insulation properties and reduce the operational energy requirement of the buildings. The advantage of these methods of insulation over other window systems which rely upon solar reflection (such as tinted and coated window films) is that they achieve heat gain reduction without greatly compromising visible light transmission. Solar reflection based systems, while achieving comparable heat gain reduction, are compromised by the increased interior lighting load necessitated by their application. Through Double and Triple Glazed Systems the heat gain/loss can be reduced by approximately 50% to 75% relative to Single Pane Glass Systems.

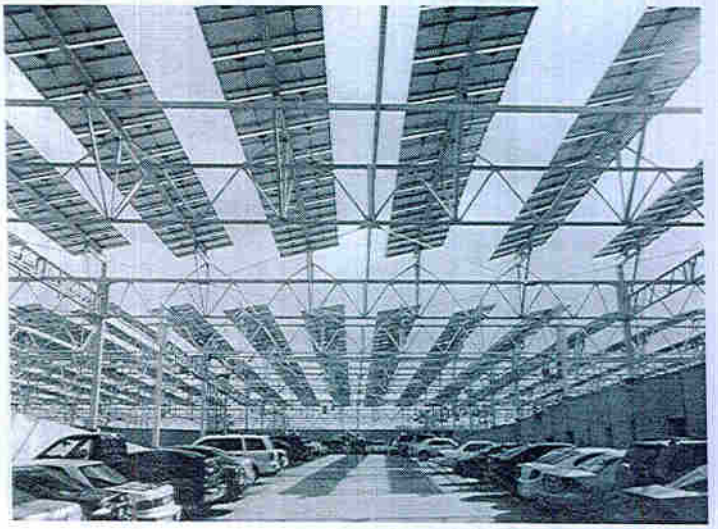
➢ **Heat Gain Reducing Paint**

- The Heat Gain Reducing Paint technology has the ability to reflect heat causing infrared rays from solar radiation. This intervention was designed to help reduce the internal temperature of the building i.e. reduce heat gain. Certification conducted by the Centre for Energy Studies and Research (CESR, India) indicates that Weather Shield Paints (i.e. solar reflective paints) can reduce the temperatures of walls by upto 50Cand that reflectivity rate for solar radiation through these paints is 0.40 relative to ordinary Currently, the MAIN DOOR of the entrance to the Branch has a significant air-gap between the frame and the door while all back-office doors meant to separate Air Conditioned Spaces from non-conditioned spaces are either missing or kept ajar at all times. exterior wall paint which exhibit a reflectivity rate of 0.21. i.e. these paints are approximately twice as effective in curbing building wall temperature rise due to solar radiation.

➢ **Renewable Power Feasibility at Adani House :**

- Plant first can install LED lights and then can install solar PV system so that requirement of project kW will be reduce.

Solar Panel Installation on Parking Shed



- Plant can use the parking space or another non utilize space with feasibility study of solar PV panel installation.

Advantages of Water Percolation and Water Harvesting:

Rainwater harvesting is collecting the run-off from a structure or other impervious surface in order to store it for later use. Traditionally, this involves harvesting the rain from a roof. The rain will collect in gutters that channel the water into downspouts and then into some sort of storage vessel. Rainwater collection systems can be as simple as collecting rain in a rain barrel or as elaborate as harvesting rainwater into large cisterns to supply your entire household demand.

The idea of rainwater harvesting usually conjures up images of an old farm cistern or thoughts of developing countries. The reality is that rainwater harvesting is becoming a viable alternative for supplying our households and businesses with water. It's not just for the farm anymore! There are many countries such as Germany and Australia where rainwater harvesting is a norm. Due to the green building movement, you will be seeing rainwater harvesting systems become more popular here in America.

The collection of rainwater is known by many names throughout the world. It ranges from rainwater collection to rainwater harvesting to rainwater catchment. In addition, terms such as roof water collection or rooftop water collection is also used in other countries.

We believe that rainwater harvesting is a viable technology in an urban setting. All that is necessary to take advantage of this resource is to capture the free water falseing on your roof and direct it to a rainwater storage tank. By doing this, you can take control of your water supply and replace all or at least a substantial portion of your water needs. Rainwater harvesting systems can be configured to supply your whole house and/or your landscape needs.

What are the benefits of rainwater collection?

- Rainwater is a relatively clean and absolutely free source of water
- You have total control over your water supply (ideal for cities with water restrictions)
- It is socially acceptable and environmentally responsible
- It promotes self-sufficiency and helps conserve water
- Rainwater is better for landscape plants and gardens because it is not chlorinated
- It reduces storm water runoff from homes and businesses
- It can solve the drainage problems on your property while providing you with free water
- It uses simple technologies that are inexpensive and easy to maintain
- It can be used as a main source of water or as a back up source to wells and municipal water
- The system can be easily retrofitted to an existing structure or built during new home construction
- System are very flexible and can be modular in nature, allowing expansion, reconfiguration, or relocation, if necessary
- It can provide an excellent back-up source of water for emergencies

What Are The Uses Of Collected Rainwater

You can essentially use rainwater anywhere you use tap water. The idea of using drinking water to flush our toilets and water our lawns is wasteful and irresponsible, especially in light of population growth and water shortages across the country. Rainwater collection is a technique to green your home and to lessen your environmental footprint.

There are basically three areas where rainwater can be used:

- Irrigation use
- Indoor, non-potable use
- Whole house, potable use

Here are some ideas for specific uses of rainwater:

- Hand water your lawn and garden
- Connect rainwater collection system to irrigation/sprinkler system
- Wash your vehicles

- Wash your pets
- Refill your fountains and fish ponds
- Refill your swimming pool
- Replace the use of tap water with rainwater to wash your driveways and sidewalks (if you don't use a broom)
- Use it for all indoor non-potable fixtures (toilets and clothes washer)
- Use it for all potable needs when properly filtered and disinfected
- Use it for industrial processes instead of municipally treated water

How Much Rain Can I Collect ?

The amount of rainfalse that you can collect is governed by the following formula:

1" of rain x 1 sq. ft. = 0.623 gallons

Or put in an easy form to remember :

1" of rain from 1,000 sq. ft. will provide 623 gallons

To calculate the amount of rainwater you can collect, you need to know your annual average precipitation for your area.

Water Percolation:

In this method rain water collected from the roof of the building is diverted to a storage tank. The storage tank has to be designed according to the water requirements, rainfalse and catchment availability. Each drainpipe should have mesh filter at mouth and first flush device followed by filtration system before connecting to the storage tank. It is advisable that each tank should have excess water over flow system.

In this method rain water collected from the roof of the building is diverted to a storage tank. The storage tank has to be designed according to the water requirements, rainfalse and catchment availability. Each drainpipe should have mesh filter at mouth and first flush device followed by filtration system before connecting to the storage tank. It is advisable that each tank should have excess water over flow system.

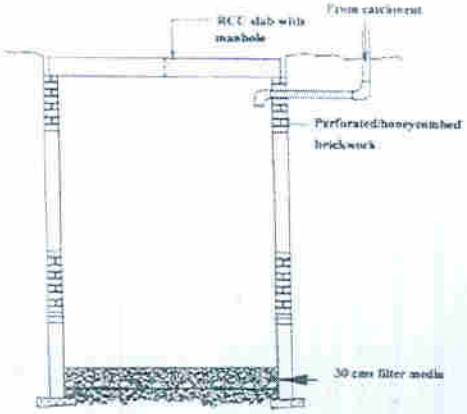
Ground water aquifers can be recharged by various kinds of structures to ensure percolation of rainwater in the ground instead of draining away from the surface. Commonly used recharging methods are:-

a) Recharging of bore wells
b) Recharging of dug wells.
c) Recharge pits
d) Recharge Trenches
e) Soak ways or Recharge Shafts
f) Percolation Tanks

Recharging of bore wells

Rainwater collected from rooftop of the building is diverted through drainpipes to settlement or filtration tank. After settlement filtered water is diverted to bore wells to recharge deep aquifers. Abandoned bore wells can also be used for recharge.

Optimum capacity of settlement tank/filtration tank can be designed on the basis of area of catchment, intensity of rainfalse and recharge rate as discussed in design parameters. While recharging, entry of floating matter and silt should be restricted because it may clog the recharge structure. "first one or two shower should be flushed out through rain separator to avoid contamination. This is very important, and all care should be taken to ensure that this has been done."



Typical recharge pit

- Roof or terraces uses for harvesting should be clean, free from dust, algal plants etc.
- Roof should not be painted since most paints contain toxic substances and may peel off.
- Do not store chemicals, rusting iron, manure or detergent on the roof.
- Nesting of birds on the roof should be prevented.
- Terraces should not be used for toilets either by human beings or by pets.
- Provide gratings at mouth of each drainpipe on terraces to trap leaves debris and floating materials.
- Provision of first rain separator should be made to flush off first rains.
- Do not use polluted water to recharge ground water.
- Ground water should only be recharged by rainwater.
- Before recharging, suitable arrangements of filtering should be provided.
- Filter media should be cleaned before every monsoon season.
- During rainy season, the whole system (roof catchment, pipes, screens, first flush, filters, and tanks) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.
- At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed off all sediments and debris

Appendix - I

ELECTRICITY BILL

APENDIX – I

ELECTRICITY BILL

CONSUMER NO: 200008 FROM DEC 15 TO AUG 16 & 200033 FROM SEP 16 TO NOV 16

MUPL

Month	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16
Contract Demand (KVA)	900	900	900	900	900	900	900	900	900	500	500	500
85 % Billing Demand (KVA)	765	765	765	765	765	765	765	765	765	425	425	425
Billing Demand (KW)	765	765	765	824	895	900	900	900	883.5	479.5	452.5	425
Actual Demand (KVA)	517	508	580	832	904	1069	1052	1008	892	484	457	346
Average PF (%)	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.98
Total Unit Consumption (Kwh)	197770	186010	189520	258350	291560	361020	364040	311820	280120	168420	151190	117810
TOU Units (Kwh)	65924	62003	63173	86117	97187	120340	121346	103940	93374	56140	50395	39270
Fixed Charges (Rs.)	626076	626076	585684	674361.6	708840	736560	712800	736560	723056.4	241668	252495	229500
EXCESS Demand Charges (Rs.)	0	0	0	0	4276.8	186718	162518.4	119322.7	0	0	0	0
Energy Charges (Rs.)	702083.5	660335.5	672796	917142.5	1020460	1263570	1274140	1091370	980420	522102	468689	365211
Load factor (%)	53.1	50.9	45.4	43.1	44.8	46.9	48.1	43.0	43.6	48.3	45.9	47.3
FPPPA Charges (Rs.)	166126.8	174849	238795	325521	367366	454885.2	458690.4	280638	252108	151578	98273.5	76576.5
PF Adjustment Charges (Rs.)	-3619.19	-3403.98	-3468.2	-4727.8	-5335.4	-6606.66	-6661.92	-5706.3	-5126.19	-3082.08	-2766.77	-1837.83
Meter Rent (Rs.)	750	750	750	750	750	750	750	750	750	750	750	750
Electricity Duty (Rs.)	0	0	0	0	0	0	0	0	487614.55	228066.48	204172.68	167362.42
Total Bill (Rs.)	1491417	1458607	1494557	1913047.3	2096357	2635877	2602237	2222934	2438823	1141082	1021613	837562

Appendix -II

MONTHLY FUEL & WATER CONSUMPTION

APPENDIX- II

FUEL CONSUMPTION

- Monthly Diesel Consumption

Sr. No	Month	Fuel Consumption in (Ltr)
1	Dec-15	200
2	Jan-16	675
3	Feb-16	100
4	Mar-16	1525
5	Apr-16	90
6	May-16	95
7	Jun-16	75
8	Jul-16	110
9	Aug-16	160
10	Sep-16	90
11	Oct-16	40
12	Nov-16	10
	Total	3170

Appendix -III
PCC/MCC LOADING

➢ **PCC/MCC LOADING**

Sr. No.	Identification	Volt	Amp.	KW	PF	%THD (V)	%THD (A)
1	120 kVA UPS 2	418	40.7	11	-0.39	1.28	17.4
2	Raw Power DB	416	10	6.95	0.97	1.2	25.4
3	Main Lightning panel	416	26.8	14.9	0.77	1.3	12.3
4	APFC Panel	420	63.5	46	0.99	1.2	42.5
5	UPS 120 kVA 1	420	39.8	12.40	-0.43	1.8	16.4
6	UPS 120 kVA 3	421	40	12.4	-0.43	1.6	16.5
7	Law AC Panel	423	88.6	55.4	0.85	1.6	2.9
8	UPS 30 kVA 1	420	16.6	10.6	0.87	1.4	80.3
9	UPS 30 kVA 2	415	17.3	11.00	0.88	2.1	79.5
10	Kitchen LDB	422	10.4	6.40	0.84	1.6	1.03
11	Emersion Outdoor(spare)	418	10.3	5.18	0.69	1.4	3.7
12	RPDB 101	417	7.17	4.99	0.96	1.4	19.9
13	RPDB 102	417	8.51	6.09	0.99	1.1	1.3
14	RPDB 201	420	8.64	6.15	0.98	1.6	50.4
15	RPDB 202	NO LOAD					
16	RPDB 301	NO LOAD					
17	RPDB 302	418	11.20	8.05	0.99	1.3	5.4
18	RPDB 401	NO LOAD					
19	RPDB 402	421	11.80	8.61	1.00	1.4	3.6
20	RPDB 501 & 502	NO LOAD					
22	Canteen Exshaust fan	401	8.65	2.46	0.41	1.6	1.8

Appendix –IV
LIST OF SUPPLIERS/ MANUFACTURERS

APPENDIX – IV
VENDOR/ MANUFACTURERS LIST

Sr. NO	Product/ Equipment	Contact Details
1	Lighting-T5	L-141 MIDC industrial area Ahmednagar-414111 Tel.0241-2779835/2778978 Email-ceo@eetamax.com Contact person: Mr.Dilip Joshi (CEO) Cell.9850895772
2	Energy conserver system for lighting load	Mag. Flux Power saver GLOABTEL convergence Ltd Contact person Mr.Rashes Joshi (DGM Sales) Cell No: +91 9322338581
3	Aircosaver (Energy saving in air conditioning system)	Ecopower Pvt. Ltd. 105 Neelkanth, 98 Marine Drive, Mumbai 400 002 INDIA. Telephone : +91 (22) 22839645 Fax : +91 (22) 22839646
4	Capacitors	Shreem Capacitors Pvt. Ltd. 7/39, Vikram Vihar, Lajpat Nagar-IV, New Delhi – 11024
5	Capacitors and APFC Panels	Matrix Controls & Engineers Pvt Ltd Rajeev Batra 9811624440, Rajeev@matrixcapacior.com E- 725 DSIDC, Industrial Complex, Narela, GT Road, Delhi – 110040 Ph: 01127786945 / 46 / 47, www.matrixcapacitor.com
6	Capacitors and APFC Panels	Saif Electronics 174, Hira Building, 1st Floor, Carnac Road, Opposite Police Commissioner office , Mumbai – 400002 Ph : 022 – 22064626 , 22086613, www.saifel.com
7	Lighting Systems	Philips India Ltd Regional office-North, 9th floor Ashoka Estate, 24, Barakhamba Road New Delhi – 110 001 Telephone No.: 3353280, 3317442, Fax No.: 3314332
8	Lighting Systems	OSRAM India Ltd. Signature Towers, 11th Floor, Tower B, South City-I, Gurgaon 122001, Haryana Tel: 0124- 6526175, 6526178, 6526185
9	Lighting Systems	1)Wipro Limited

		Sco 196-197, Sector 34-A, Chandigarh - 160 022 2) Daril Lighting Pvt. Ltd. Ph: +91-265-2341774 M: 9925018665 Email: ceo@darilighting.com 3) Surya Roshni Ltd. Contact Person: Rohan Dave, Asst. Manager M: 9825513086; Email: suryaroshniahd@gmail.com
10	Lighting Voltage Control Systems	ES Electronics (India) Pvt. Ltd. Plot No.82, KIADB Industrial Area, Bommasandra – Jigani Link Road, Jigani Hobli, Anekal Taluk, Bangalore District – 562 106 Telefax: +91 - 8110 – 414547 / 414548,414549 / 414550 E-mail ID: eleindia@energysaversindia.com Website: www.energysaversindia.com
11	HVAC	Voltas Limited 19 J N Heredia Marg Ballard Estate Mumbai – 400038 Energy Audit Draft Report
12	Pumps	1) Shakti Pumps India Ltd. Tel: +91-7292-410500 Email: sale@shaktipumps.com 2) Lubi Industries LLP Tel: +91 79 30610100 Email: indsales@lubipumps.com 3) Grundfos Tel: +91 79 4003618 salesindia@grundfos.com
13	Variable Speed Drives	ABB India Ltd. Contact: Tukaram Korke, Manager-sales Ph: +91-20-66243828 M: +91-9765551612 tukaram.korke@in.abb.com

2016-17

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Date : 21.01.2017
Assign No. : SO/16-17/03594
Date: 25/10/16

adani™

Energy Audit Report PUB (5A-1, 5A-2 & 5B) Buildings

Prepared for

Adani Ports and Special Economic Zone Limited
Post Bag No. 1, Village - Dhrub,
Tal - Mundra, Kutch 370421
Gujarat

Prepared by

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Navrangpura, Ahmedabad-380 009

January -2017

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Delivery Challan No.: 59-2 **Date: 21.01.2017**

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Prepared by: Chintan Shah

Checked By: Shakil Mansuri

Approved by: Deepak Zade

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ABBREVIATIONS

°C	Degree Centigrade
A	Ampere
AC	Alternating Current
Avg.	Average
APSEZL	Adani Ports & SEZ Ltd.
BEE	Bureau of Energy Efficiency
cm.	Centimeter
Cr.	Crore
CHW	Chilled Water
CHWP	Chilled Water pump
CW	Cooling Water
CWP	Cooling Water Pump
DC	Direct Current
DG	Diesel Generator
Dia.	Diameter
Ft. or ft	Feet
F.O.	Furnace Oil
FD	Forced Draft
GoI	Government of India
gm.	Gram
hr.	Hour
ID	Induced Draft
Ins.	Insulated
kCal	Kilo Calories
kg.	Kilogram
KL	Kilo Liter
kV	Kilo Volt
kVA	Kilo Volt Ampere
kVAr	Kilo Volt Ampere Reactive
kW	Kilo Watt
kWh	Kilo Watt Hour
Lit	Liter
Lt	Liter
Ltd.	Ltd.
M or m	Meter
Max.	Maximum
MD	Maximum Demand
Min.	Minimum
MITCON	MITCON Consultancy & Engineering Services Ltd.
m	Meter
Mm	Millimeter
MT	Metric Ton
MW	Mega Watts
No.	Number
N.G.	Natural Gas
p.a.	Per Annum
PF	Power Factor
Rs.	Rupees
Temp.	Temperature
V	Voltage
VFD	Variable Frequency Drive
yr.	Year

HIGHLIGHTS OF THE REPORT

A.	-	A Profile
• Location	-	Adani Ports & SEZ Ltd., Post Bag No.1 Village Dhrub, Taluka: Mundra, Gujarat
• Year of Establishment	-	
• Business Activity	-	3 buildings; 5A-1 Port Utility Building has different offices, banks, post office; 5A-2 PMC building has different offices; 5B Customs building has different offices
B. Energy Scene		
• Total Annual Energy Bill	-	Rs. 0.983 Cr (Dec-15 to Nov-16)
• Electricity Supply Company	-	MUPL
• HT Connection No. & Contract Demand	-	200008 & 400 KVA
• Major Energy Sources	-	Electricity and Diesel
• Major Connected Loads	-	Air conditioner, lighting, ceiling fan, printer copier, computers, etc.
C. Contact Details		
• -Engineer In charge	-	Mr. Shailesh Kanjariya Dy. Manager (Asset Management) 9925150057, 2838255317
• E-Mail	-	Shailesh.kanjariya@adani.com

D. Key Result Areas for Energy Savings & Estimated Potential along with Broad Cost Benefit.

Sr. No.	Energy Saving Area	Saving Potential in Kwh Lacs	Saving Potential in Rs. Lacs	Investment in Rs. Lacs	Simple Payback Period in Months
I. SHORT TERM AREAS					
1	Saving with Power factor Improvement		0.21	Nil	Immediate
Subtotal (I)			**0.21**	**Nil**	**Immediate**
II. MID TERM AREAS					
2	Energy Saving with AVC for lighting load in PUB, PMC, Customs Buildings	0.088	0.652	1.0	18
3	Energy Saving by replacing existing UPS with Energy Efficient UPS	2.099	15.54	25	19
Subtotal (II)		**2.188**	**16.63**	**26**	**19**
III. Long TERM AREAS					
4	Replacement of conventional fans with Energy Efficient fans	0.013	0.102	0.312	37
Subtotal (III)		**0.013**	**0.102**	**0.312**	37
Intangible areas of energy saving					
5	Turning off lights in unoccupied areas				
6	Building-Envelope & Air-Conditioned Space Insulation				
7	Incorporating Evaporative Air Cooling				
8	Direct Evaporative Water Spraying Technology				
9	Enhanced Use of Natural Lighting				
10	Building-Envelope & Air-Conditioned Space Insulation				
11	Heat Gain Reducing Paint				
12	Overhaul of Refrigerant Piping Insulation & Filter Maintenance				
13	Optimal AC Temperature Setting				
	Grand total (I+II+III)	**2.201**	**16.504**	**26.312**	**19**

EXECUTIVE SUMMARY

1. Saving with Power Factor Improvement

PUB PF Improvement saving for last three month

Month	Unit consumption	Monthly Power Factor	Proposed Power Factor	Rebate Power factor	Rebate on existing power factor	Potential Rebate on proposed power factor
Sep-16	125650	0.9	0.999	0.008	0	2635
Oct-16	109760	0.97	0.999	0.027	1416	2302
Nov-16	83835	0.9	0.999	0.029	0	1758
					1416	6696

- As per MUPL Electricity bills Rebate taken on existing power factor is **Rs. 1416**/3months (from Sep 16 to Nov16)
- After Improving Power Factor Potential Rebate on proposed power factor Saving is **Rs. 6696**/3months (from Sep 16 to Nov16) For each 1% improvement in the Power Factor from 90% to 95% Rebate of 0.15 Paise per Unit and For each 1% improvement in the Power Factor above 95% Rebate of 0.27 Paise per Unit
- Average PF is observed **0.89** during field audit
- Saving Achieved is Rs. **21118**/year

2 Energy Saving by replacing existing UPS with Energy Efficient UPS

Sr. No.	Description	Unit	Value
1	Working Hours/year	Hr.	8640
2	Unit rate in Rs.	Rs.	7.6
3	Saving unit in year	kW	209943
4	Saving Rs. in year	Rs. In Lac	15.54
5	Investment for New High efficiency UPS	Rs. In Lac	25
6	Payback in months	month	19

3 Energy Saving with AVC for lighting load in PUB, PMC, Customs Buildings

Sr. No.	Particulars	Values	Unit
1	Measured Lighting load PUB Building during day time	25	kW
2	Present Average Voltage at Receiving End (V1)	240	V 1-ph
3	Proposed Operating Voltage after Installing AVC (V2)	230	V 1-ph
4	Power (P1)	V^2/R	

Sr. No.	Particulars	Values	Unit
5	Power (P2)	$P1(V2/V1)^2$	
	day time	23	kW
6	Power Savings at Present Lighting Load	2	kW
7	Total Annual Operating Time day and night	4320	hr
8	Total Saving Potential	8812	kW
9	Total Savings Potential	65213	Rs. @ 7.6 Rs./kWh
10	Investment of transformer tap changing	100000	Rs.
11	Simple Payback Period	18	month

4 Replacing conventional cooling utilities with energy efficient utilities

for 1 ton									
EER		kwh	nos.	Working Hr./Annum	unit rate Rs.	Saving in Kwh	Saving in Rs./Annum	Investment in Rs.	Payback period in month
2 star	3	1.154	11	1440	7.4	2693	19226	220000	137
5 star	3.6	0.984							
		0.17							
for 1.5 ton									
EER		kwh	37	1440	7.4	15984	118281	851000	86
2 star	2.9	1.7							
5 star	3.6	1.4							
		0.3							
Gorrila ceiling fan									
existing Wh		60	13	3240	7.4	1348	9974	31200	37
Proposed Wh		28							

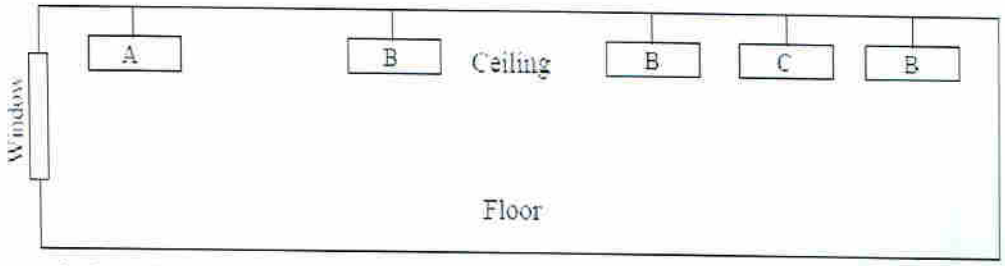
Turning off lights in unoccupied areas.

- An easy and effective measure is to encourage personnel to turn off lights in unoccupied building spaces. An energy management program that aims to improve the awareness of personnel with regard to energy use can help staff get in the habit of switching off lights and other equipment when not in use.

Lighting placement and controls.

- An example of energy efficient lighting control is illustrated by Figure 8, which depicts five rows of overhead lights in a workspace. During the brightest part of the day, ample daylight is provided by the window and thus only row C would need to be turned on. At times when daylight levels drop, all B rows would be turned on and row C would be turned off. Only at night or on very dark days would it be necessary to have both rows A and B turned on.

Lighting Placement & Control



- retrofit by adapting the luminaries already present. (For example, turning on the lighting in the rows away from the windows during the brightest parts of the day and turning on supplemental rows as needed later.)

Daylighting.

- Daylighting involves the efficient use of natural light in order to minimize the need for artificial lighting in buildings. Increasing levels of daylight within rooms can reduce electrical lighting loads by up to 70% Unlike conventional skylights, an efficient daylighting system may provide evenly dispersed light without creating heat gains. The reduced heat gains will reduce the need for cooling compared to skylights. Daylighting differs from other energy efficiency measures because its features are integral to the architecture of a building; therefore, it is applied primarily to new buildings and incorporated at the design stage. However, existing buildings can often be costeffectively refitted with daylighting systems. Various daylighting systems are available on the market, some of which can be supplied as kits to retrofit an existing building.

PREFACE

- Adani Ports and Special Economic Zone Ltd (APSEZ) is part of Adani Group – a $9.4 billion conglomerate with business is ports and logistics.
  APSEZ represents a large network of ports with India's largest Special Economic Zone (SEZ) at Mundra. APSEZ Business is integral to its Logistics Business done in the name of Adani Ports & Logistics and is India's largest private port operator with presence across 8 locations with state of the art infrastructure.

- Mundra Port, located in the Kachchh district of Gujarat state is the largest among all ports of APSEZ and acts as a gateway for north-western India.

- APSEZ with a total cargo throughput of 127 MMT in 2013-14 is poised to exceed 200MMT of cargo by 2020.

➢ The Adani Group has many distinctions to its merit:

- Operator of the largest private port in India
- Developer of the largest multiproduct SEZ in India
- Owns the largest edible oil refining capacity in India
- One of the largest trading houses in India
- Largest Integrated Coal Management Firm in India
- Promoter of India's first supercritical technology based power plant
- Operator of the world's largest automated import Coal Terminal having 60 MnT capacity

ACKNOWLEDGEMENTS

- An energy audit is a joint venture of consultant and industry to account & contain energy usage without sacrificing the purpose of usage of energy. The contribution of Adani Ports And SEZ Ltd. (APSEZL) team is equally important in this venture. We sincerely acknowledge the contribution of the following dignitaries and site engineering personnel because of whom the study could progress smoothly –

Sr. No.	Name	Designation
1	Mr. Nirav Shah	Associate Gen Manager (Engineering Services)
2	Mr. Shailesh Kanjariya	Deputy. Manager (Asset Management)
3	Mr. Jagmal Nandaniya	Sr. Engineer (Engineering Services)
4	Mr. Sanjay Trivedi	Engineer (Asset Management)
5	Mr. Vishwajeet Jadeja	Electrical Engineer

- We are also thankful to the other staff members who were actively involved while collecting the data and conducting the field studies.

Chapter 1 Introduction

1.1 PREAMBLE

- Adani Ports and SEZ Ltd. is a well-known name in Ports logistics and customs shipping. The various business carried out in APSEZL included ship docking, customs, ports, logistics, infrastructure, Oil and gas, etc.
- 5A-1, namely Ports Utility Building, 5A-2 namely PMC building, and 5-B, namely Customs buildings, consists of different offices, banks, store rooms, server rooms, etc.
- Average annual energy bill is Rs. 0.983 Cr. (Dec-15 to Nov-16) after deducting Adani House Contribution in Electricity bill from Dec 15 to Sep 16. Electricity consumption is shares the major chunk in the total annual energy bill i.e. up to 98.6 %, Energy share of Diesel is nearly 1.4 %.
- In order to reduce increasing energy costs, APSEZL approached MITCON for conduct of energy audit. MITCON submitted its vide proposal no. ECS/EEC/AL/2016-17/366 dated Sep 21, 2016. This proposal was accepted by APSEZL vide its purchase order no. 4800022101 dated Oct 20, 2016.

- This energy audit report for APSEZL, Mundra presents the analysis of the data collected, observations made and field trials undertaken from 20 Dec, 2016 to 30 Dec, 2016. It is governed by the objectives, scope of work, and methodology discussed in ensuing paragraphs.

Baseline Parameters for Energy Audit

Parameter	Value	Unit
Plant Operating Days	300	Days/year
Plant Operating hours	9	Hr/day
Electricity Unit Rate for saving calculation	7.4	Rs./kWh
Diesel unit rate	55	Rs./ltr
Diesel density	0.834	kg/ltr
Diesel GCV	11084	kCal/kg

1.2 OBJECTIVES

- To undertake an energy audit so as to identify areas for energy saving, both without and with investment.

- To compare values for energy consumption as against the occupancy levels and identify potential areas for energy savings / energy optimization (both short-term areas requiring minor investments with attractive paybacks and mid / long term system improvement areas needing moderate investments and paybacks ranging between 12 to 30 months).

- To undertake renewable energy application assessment study.

- To prioritize distinct areas identified for energy savings depending upon saving potential, skills, and time frame for execution, investment cost, paybacks etc.

- To design an "Energy Monitoring System" for effective monitoring of energy consumption and analysis of energy efficiency.

- To provide assistance while implementation.

1.3 Scope Of Work

- To correlate monthly data of occupancy / activity with electricity, diesel and water consumption, for a period of 12 - 18 months of normal operation.

Part-I

- **Electrical**

- To study electrical energy metering, monitoring and control system existing at site and to recommend a suitable system for future monitoring.
- To study monthly power factor, maximum demand, working hours, load factor etc. for the reference period along with monthly electricity consumption and establish scope for MD control through load optimization of load factor and through detailed load management study.
- To recommend a specific rationalization / optimization program based on measurement of DB power factors, existing capacitor system and its maintenance, automatic / manual controls required etc.
- To study monthly transformer loading with existing & future connected load so as to recommend a specific rationalization / optimization plan for transformer capacity. Analysis of transformer efficiency, losses at various loadings.
- Study of APFC system working on various loadings to understand pattern of various feeders capacitors working.
- To undertake a detailed motor load study on all motors equal to and above 2 kW size with the help of a clamp on load manager to identify instantaneous motor parameters like kW, KVA, P.F., A, V, frequency etc. and establish their variations over a load cycle (for variable load drives, if any). This study will help establish / recommend motor specific rationalization plan including star conversion, downsizing, use of motor energy savers and high efficiency drives etc.
- Based on the above to evaluate the possibility of replacing major motors with energy efficient motors. To provide cost benefit analysis for the replacement policy. Analysis of suitable drive type, alignment etc. to reduce energy consumption.
- To measure current & voltage harmonics of main equipments up to 24th level with 3-Φ power analyzer & to give remedial solutions to remove / suppress harmonics. Suggestion with remedial action to install active / passive harmonics filter.
- Thermography at important electrical PCCs, MCCs & major loads above 63 A switches
- To undertake pumping energy audit on pumps having capacity above 2 kW Pumping audit will mainly cover measurement of water flow, power input, head with digital pressure gauge etc. This exercise will establish the operating duty point of each pump and possibility of energy conservation through pump capacity rationalization, impeller trimming etc. This will help to selection of energy efficient pump running.
- Recommendations on effective & precise control of blowers / fans working with modern control systems. Installation of high efficiency blowers, lobe blowers, aeration blowers for various applications.
- Study of UPS and Voltage Stabilizer System.
- To study compressed air system, in terms of compressor type, make, capacity, loading, motor type / size / loading etc. and to undertake output efficiency test for the operating compressors. This will identify opportunities for compressed air generation optimization and energy savings. Pump up test will be conduct to identify the FAD and leakage volume.

- To undertake compressed air leakages tests & recommend the locations of air leakage. Study of pressure drop and distribution network loop option to precise running of the system.
- To undertake lux survey for the major identified areas and streetlight with the help of a lux meter both during day and night time and recommend a specific plan for rationalization of lighting load through use of north light and switching off use of energy efficient lighting equipment like tri-phosphor fluorescent tube light etc. Possibility checking for installation of LED lighting, occupancy sensor, light pipe, switching point operation.
- Detailed study of streetlight and colony lighting.

- **Water - Basic Study**

- To study water receipt, storage, distribution and utilization in the plant so as to identify scope of water usage and pumping efficiencies.
- Study of R.O or D.M. generation of water & reutilization of wastage water.
- E.T.P./S.T.P. area energy consumption will be study under primary level.

- **Diesel Generator Sets**

- Measurement of electrical energy generated and fuel consumption (based on drop in fuel level)
- Evaluation of specific energy generation ratio (SEGR) and comparing with standards.
- Analysis of loading pattern on diesel generator sets.
- Waste heat recovery system installation option to be study for D.G. Sets.

- **Renewable Energy & Carbon Credits at Preliminary Study**

- To undertake renewable energy application pre-assessment study, which mainly include adaptation of onsite renewable energy technologies like solar power projects, solar thermal systems, biogas etc.
- Pilot study for carbon credits (cost benefit analysis, road map for implementation)

Part-II

- **Air Conditioning System**

- Study of air conditioners performance and efficiency
- Study of utilization factor, operations, running hours reduction by efficient utilization
- Study of maintenance factors
- Study of reduction of heat load, effective area utilization, human general behaviours, history, records, installation locations etc.
- Calculation of energy efficiency index as per standard available practices.

1.4 METHODOLOGY

- MITCON deputed following team of experts for conducting the audit and worked in close association with APSEZL.
  - Mr. Deepak Zade, Sr. Vice President
  - Mr. Krunal Shah, Asst. Vice President
  - Mr. Shakil Mansuri, Senior Consultant
  - Mr. Chintan Shah, Project Consultant
  - Mr. Maulik Patel, Certified Energy Auditor
  - Mr. Kalpesh Patel, Associate Consultant
  - Mr. Anand Shah , Associate Consultant
  - Mrs. Sangita Mainkar, Data Management
  - Mr. Jitendra Shinde, Data Management
- MITCON submitted an execution work plan for the assignment for which APSEZL provided relevant data support.
- APSEZL Nominated specific persons from Engr. / Maintenance sections along with a co-ordinator of senior managerial level for this audit.
- MITCON undertook an "Orientation Meeting" with management / Engr. / Maintenance personnel prior to start of the audit. MITCON's team conducted all necessary field trials and measurements.
- MITCON provided all the instruments necessary for conducting the field trials.
- Following instruments were used by MITCON's team.

Table 1 Instruments Used by Energy Audit Team

Sr. No.	Instrument Name	Specification
1.	Demand Analyser	Suitable for 1φ, 3φ. 156 electrical parameters like voltage, current, frequency, harmonics, active & reactive power, power factor etc.
2.	Clamp-on Power Meter	0 - 1200 kW 0 - 600 Voltage, AC 0 - 800 Voltage, DC 0 - 2000 A, Current, AC / DC
3.	Lux Meter	0 - 50,000 Lux Level Non Contact Type
4.	Digital Thermo Anemometer	0 - 45 m / sec. ± 3%
5.	Relative Humidity and Temperature Indicator	RH – 10% to 95% Temp. – 0 – 100 °C Handheld unit
7.	Infrared Thermometers	40 °C to 500 °C
8.	Portable Temperature Indicator-Digital	50 °C to 1200 °C
9.	Ultrasonic Flow Meter	0 – 15 m/sec 25 – 5000 mm pipe dia. homogeneous liquids without gas bubbles +/- 0.5 %
10.	Thermal Imager	Measure 0-500 °C of Temperature Profiles of surface area
11.	Multifunction Instrument	Measure °C, air velocity

12.	Digital Pressure Gauge	0 to 30 kg/cm2 with 0.1 kg/cm2 accuracy
13.	Stop Watch	0.00 to 2000 minutes
14.	Sling psychrometer	0-50 °C
15	Laser distance meter	0-40 m lateral distance, room area and volume

Chapter 2 Back Drop on Energy Scene

2.1 Energy Scene

- Primary energy sources for the plant are Electricity and Diesel. These sources are consumed for the various heating, cooling, lighting applications in the building, operating DG set during power cut off, etc.

- Segregation of annual energy bill is presented in the following figures. Electricity bill share is 99.16% followed by Diesel bill i.e. 0.84% of total energy bill. Diesel contribution is negligible compared to electricity.

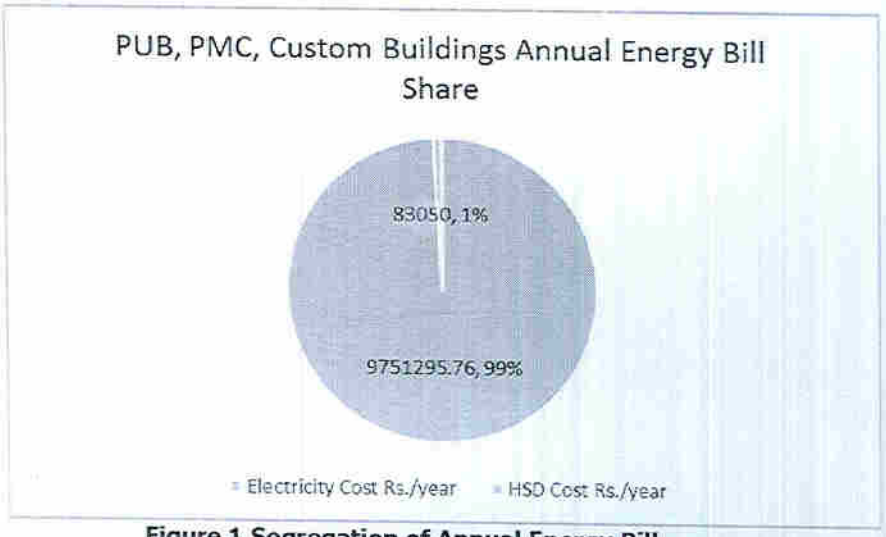


Figure 1 Segregation of Annual Energy Bill

2.2 Energy: Sources & Utilisation

2.2.1 Electricity

- The source of outside power for the buildings is from MUPL power grid at 11 KV. The power received is further stepped down to 11000 V/433 V through 1 No. 0.63 MVA and is distributed to all power distribution buses.
- Additionally, there is one DG set of 500 KVA to ensure back up power supply to the plant. D.G. set is used as power back up when power is not receiving from electricity grid.
- Present building Contract demand is 400 KVA. Facility actual demand is lower than contract demand in most of the months.
- Electricity Bills from Dec-15 to Sep-16 contained joint meter readings of Adani house+ PMC building and from Set-16 to Nov-16 PMC Building Electricity bills are separated from Adani House

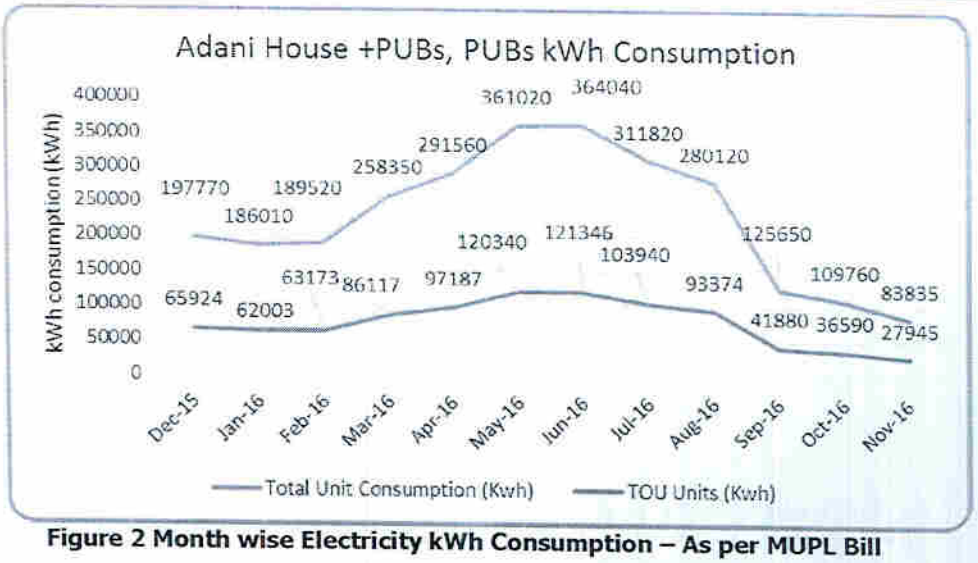


Figure 2 Month wise Electricity kWh Consumption – As per MUPL Bill

- Maximum Consumption observed in the month of Jun-16 whereas minimum consumption observed in the month of Dec-15. Average monthly consumption is 1.18 Lacs kWh. Since the bill consisted of joint meter reading from Dec-15 to Aug-16, the data analysis may not be consistent

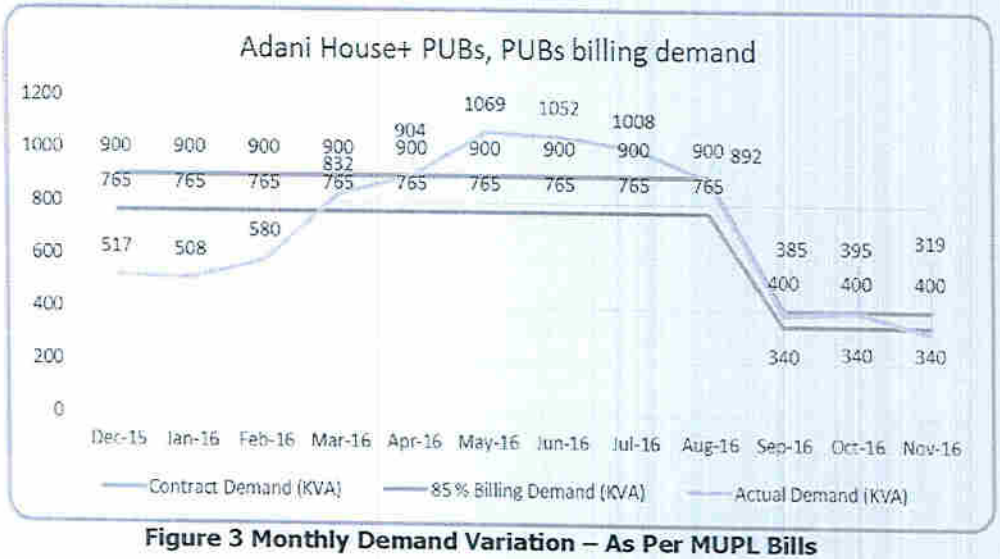


Figure 3 Monthly Demand Variation – As Per MUPL Bills

- Actual Pick demand in the month of May-16 is 1069 KVA. Actual demand is more than contract demand in the months of May June and Jul. This may be because of additional cooling requirement in summer season.

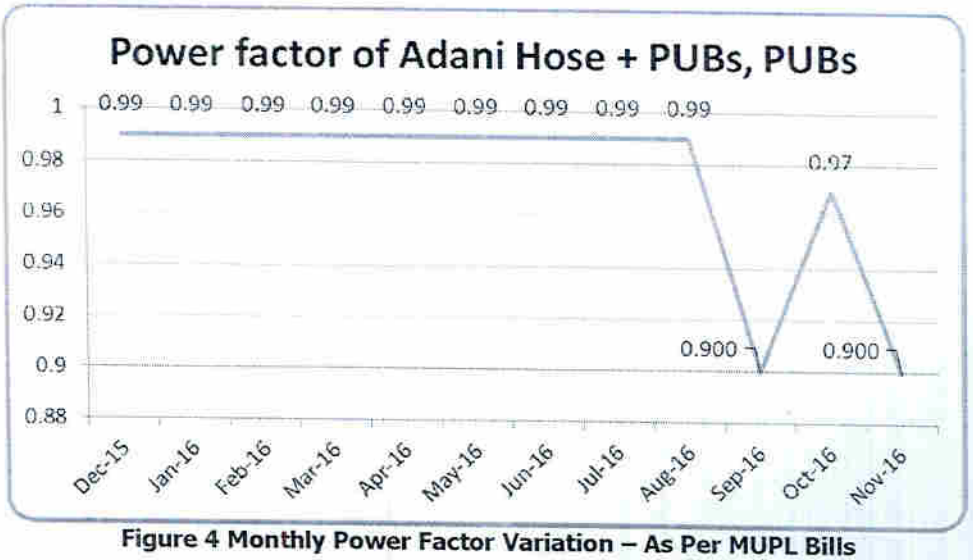


Figure 4 Monthly Power Factor Variation – As Per MUPL Bills

- Average Power factor observed is 0.99. There is a drop in power factor from Sept-16.

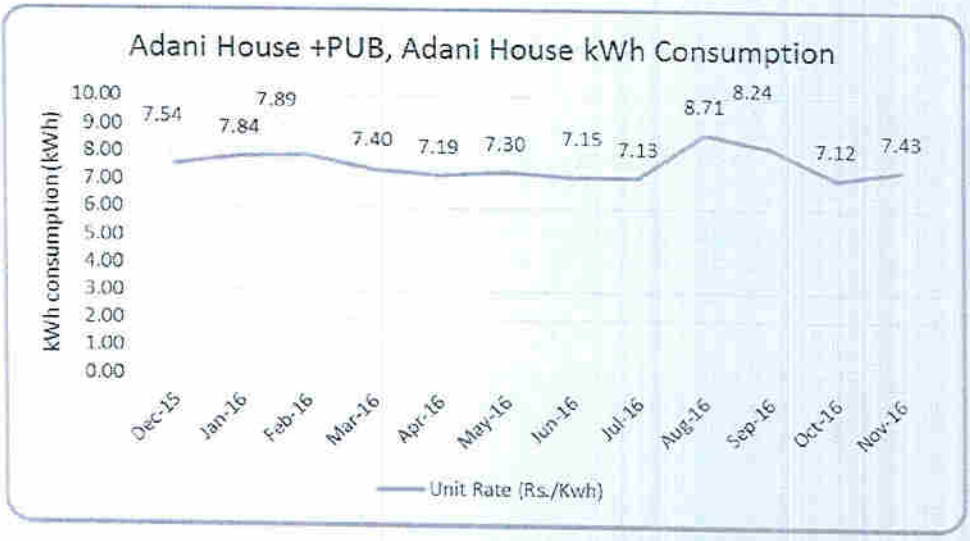


Figure 5 Monthly Electricity Rate Variation – As Per MUPL Bills

- Average unit cost as per electricity bill from Dec-15 to Nov-16 is 7.58 Rs./kWh. For Saving calculation however the average unit rate of last three months when the electricity bills are separate has been considered at 7.6 Rs./kWh for savings calculation.

2.2.2 Diesel

- Diesel is used to run the DG sets to ensure the uninterrupted power supply, whenever distribution Power supply fails. The fuel is also used for vehicle transport but APSEZL engineering dept. maintains separate records for both purposes.

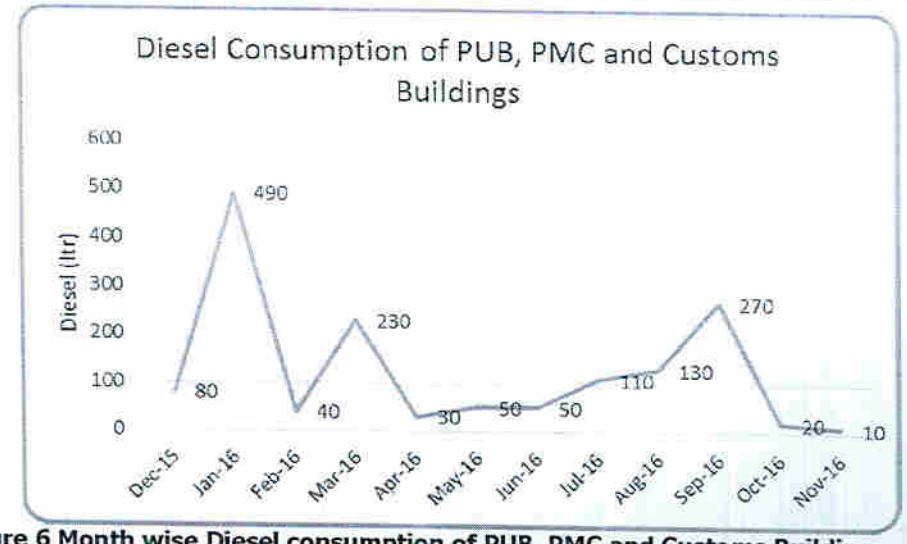


Figure 6 Month wise Diesel consumption of PUB, PMC and Customs Buildings

2.2.3 Water

- Water is Coming from Narmada and through the Pump water is used for different purposes after appropriate filtration and water quality requirements

2.3 Energy Metering, Monitoring & Control System - Existing Status

2.3.1 Electricity

- Electricity is providing by MUPL at 11 kV. Plant has metering of kWh consumption and power factor monitoring.
- During audit period it is being observed that some of the measured feeders did not have metering of Voltage, Current, kW, P.F. etc. while the energy consumption of utility was taken from their respective control panel.
- kWh and kVAh is being logged in log book by engineering department. This record is majorly kept from the common energy meter of the three buildings. Some of the offices are given on rent by APSEZL to government bodies and traders/companies, and separate energy meters are installed for their energy bills.

2.3.2 Diesel

- Diesel is being purchased and stored in diesel storage tank. Eng. Department of takes record through level indicator. Diesel is used in DG sets only during power cut off from grid and performance and reliability testing.

2.3.3 Water

- Water a source form plant is Narmada water.
- Adani House need to recording and monitoring plant water consumption and recycled water on daily basis.
- Water flow totalizers are installed at the STP water pumps for recording.

2.4 LEVEL OF AWARENESS

- Housekeeping is observed in line & maintenance is also observed in good condition.
- Water harvesting & percolation system is available at some places inside plant area.
- APFC installation at major areas shows the level of awareness in the system.
- Using of natural lighting whenever possible during day time for office use was seen at some places.
- Air conditioners with inverters are installed at few places in PMC buildings.
- Streetlights with LED fixtures has been fitted for reduction of lighting power.
- Non reflective sun films are attached to window glass at almost all the places to reduce room heating due to UV and infrared sun rays.
- Based on geographical time zone, timers for turning on/off streetlights has been installed in Adani House to PMC building.

Suggestions: -

- Open a scheme for obtaining suggestions for conserving energy.
- Display regularly the usage of energy, energy cost & consumption of all departments.

Chapter
3 Energy Conservation Opportunities
(Observations, Field Trials, Analysis and Key Result Areas)

3.1 INTRODUCTION

- The study of plant operations, data collection, observations, field trials and analysis of various areas was undertaken, keeping in view the energy scene at APSEZL, focus areas elaborated in the previous chapter and with a view to identity energy conservation opportunities in the same. The basis for this is the orientation visit, discussions with the plant personnel and the agreed plan for data collection and field trials. All these trials were undertaken at normal operating conditions.

3.2 TRANSFORMERS & DISTRIBUTION SYSTEM

- As described earlier, the source of electric power for the plant is from MPSEZ grid at incoming at 11 KV. The power received is further stepped down to 433 V through a transformer and is further distributed in plant.
- During audit period performance is tested by measuring parameters in 24 hours for TRF.
- Installation and performance of transformers is as under.

Table 2 Transformer Installation Details

Description	TRF
Make	JAYESH
KVA	630
HV Volts	11 kV
LV Volts	0.433 kV
HV AMPS	33 A
LV AMPS	840
Impedance Voltage (%)	5.13
Cooling Type	ONAN
Connection	Dy11
Temp Rise of Oil	55 °C
Serial No.	63011002
Year of Mfg.	2008

Table 3 Electrical parameters of TRF

Parameter	V	A	PF	KW	Hz	% V THD	%I THD
Maximum	431.1	350.2	0.929	184.63	50.25	1.1	36.4
Minimum	417.7	67.7	0.839	55.17	49.83	2	6.3
Average	424.5	176.9	0.89	99.71	50.00	1.52	17.57

Table 4 Transformer Efficiency

Sr. No.	Description	Units	TRF
1	Rated KVA	KVA	630
2	Rated No Load Loss	kW	1.26
3	Rated Copper Loss	kW	9.3
4	Average Operating Demand	KVA	112
5	Average Operating Load	kW	100

Sr. No.	Description	Units	TRF
6	Average Operating PF	P.F	0.935
7	%Loading at Max. Effi.	%	36.81
8	% Loading at Present	%	17.78
9	Operating Load Loss	kW	0.29
10	Total Operating Load Loss	kW	1.55
11	Power Out Put	kW	104.72
12	Power Input	kW	106.27
13	Efficiency at avg. load	%	98.54
14	Efficiency at max. load	%	98.83
15	Efficiency at min. load	%	97.59

* Considering Average load per day

- 24 hr. power measurement of TRF transformer was conducted which included monitoring of variation in voltage, load, power factor, Current, harmonics and other incidental parameters. The detailed 1-minute interval data logging is available separately in chart and Load cycle as shown below.

➢ **630 KVA Transformer**

The brief summary charts for variation in voltage, Current, Demand & P.F. is presented below.

Figure 7 Variation of Voltage in TRF

- The plot of voltage vs. time has been separately prepared to analyse the variation. The same is typical for the day and may vary daily. The chart indicates a normal range of 420 to 431 V with an occasional peak of 431 V and a low of 417 V. The average for the day is 425 V. Voltage measurements at several equipment's over other days also indicates similar pattern.

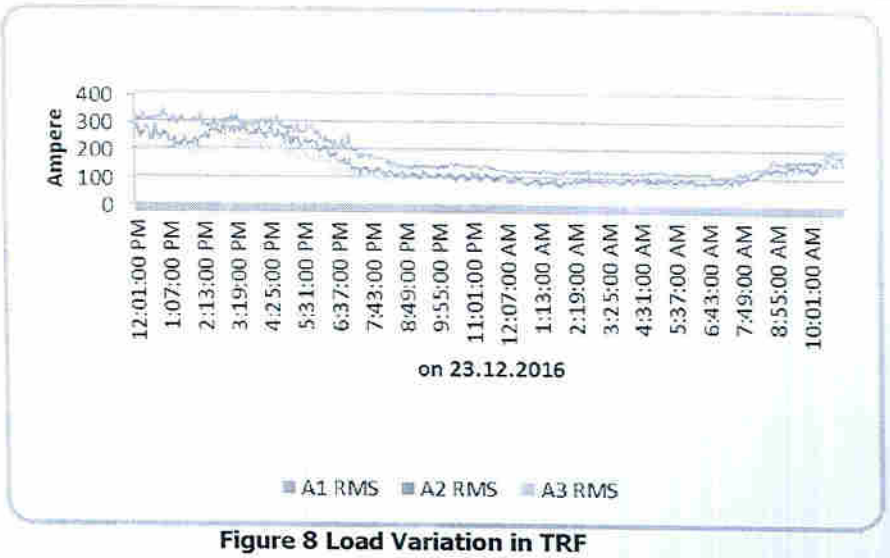


Figure 8 Load Variation in TRF

- The load pattern indicates maximum load 350 A, whereas minimum load is 67 A. Average load observed 176 A.

- The power factor pattern needs to be noted along with the load pattern. As can be noted from below chart, the P.F. goes nearer to unity as load drops and low when the load increases.

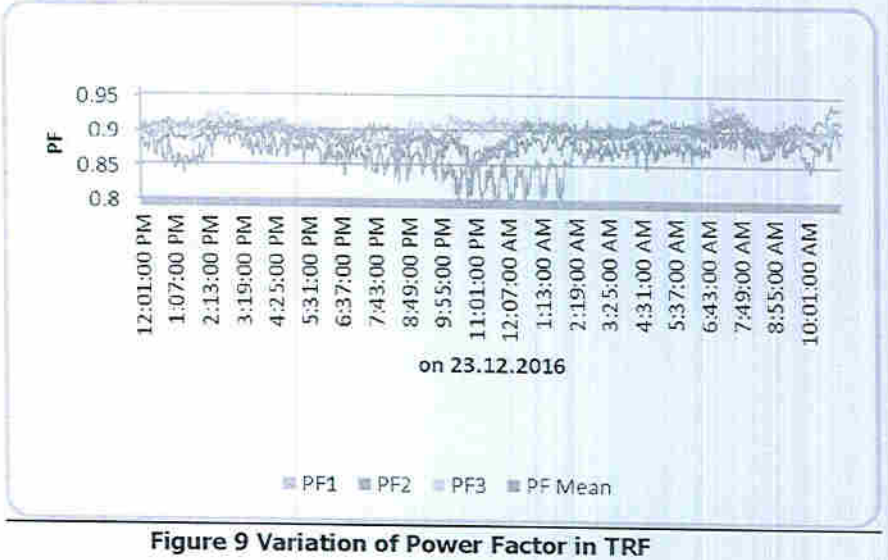


Figure 9 Variation of Power Factor in TRF

- The P.F. is hunting continuously with load indicating that the P.F. system requires fine tuning. The average P.F. is nearly **0.89**.

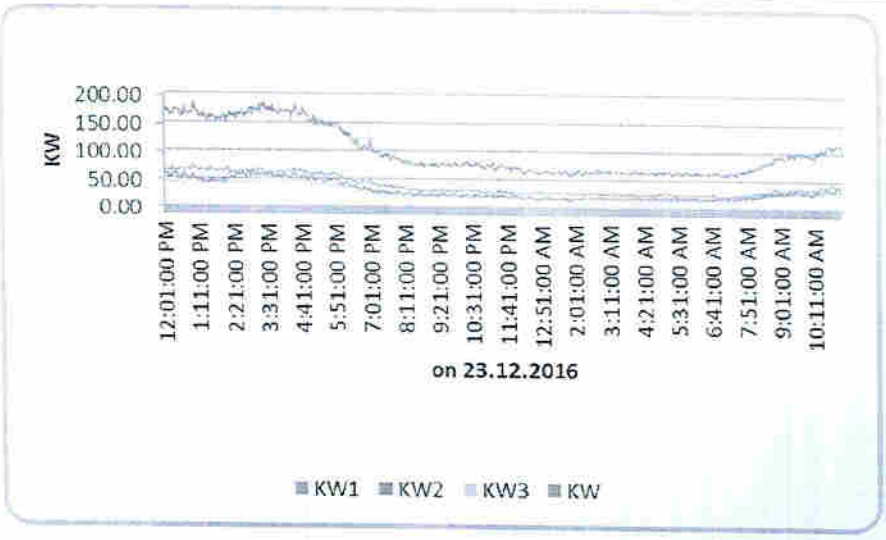


Figure 10 Power Variation in TRF

- The load pattern indicates maximum power 186 kW, whereas minimum power is 55 kW. Average power observed 98 kW.

Observation & Recommendations for Electrical distribution system

- Measured PF of transformer is between 0.85 to 0.95.
- APFC panel is installed in power distribution system but is dysfunctional. Primary reason being that the energy meter of many offices in all three building are given on rent basis.
- It is recommended to install capacitor banks and APFC panels to present PDB.
- Capacitor panel Found in off condition.

PUB PF Improvement saving for last three month

Month	Unit consumption	Monthly Power Factor	Proposed Power Factor	Rebate Power factor	Rebate on existing power factor	Potential Rebate on proposed power factor
Sep-16	125650	0.9	0.999	0.008	0	2635
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- After Improving Power Factor Potential Rebate on proposed power factor Saving is **Rs. 6696**/3months (from Sep 16 to Nov16) For each 1% improvement in the Power Factor from 90% to 95% Rebate of 0.15 Paise per Unit and For each 1% improvement in the Power Factor above 95% Rebate of 0.27 Paise per Unit

- Average PF is observed **0.89** during field audit
- Saving Achieved is Rs. **21118**/year

3.3 HARMONICS STUDY

- Harmonics are one of the most well-known power quality phenomena and are the result of the distortion of sinusoidal signal of the voltage and / or current. Distorted waveforms can be broken down into sum of components at the fundamental frequency and at the frequencies multiple of the fundamental one. Harmonics are signal components with frequencies that are integer multiples of the fundamental operating frequency of the system.

- The distortion of the sinusoidal waveform and the presence of harmonics are originated by the nonlinear characteristics typical of several devices like UPS and other electronic equipment etc. It is common to use general indexes of harmonics distortion such as Total Harmonic Distortion (THD), a parameter that briefly quantifies the harmonic distortion of a signal.
- The presence of harmonics in a network with capacitors causes a current overload on the capacitor itself and results in increase in temperature and reduces the life of capacitors. Further, the problems that may originate from the presence of harmonics are overload in the PF correction capacitor banks, overload of the neutral conductor, additional losses in transformers and in rotating electrical machines, measurement errors in the counters and untimely triggering of safety relays, disturbance and faults in electronic equipment and computers.

➢ **Effect of Harmonics:** The presence of harmonics in a network would result in:

- Current overload on the capacitor and increase in temperature which reduces the life of capacitors.
- Increased resistance of conductors thereby increased losses and thermal failures.
- Additional losses in transformers and in rotating electrical machines.
- Measurement errors in the counters and untimely triggering of safety relays.
- Disturbance and faults in electronic equipment and computers.
- Study of harmonics was carried out for approximately for 24 hours at an interval of 1 minutes and the summary of observations are presented below.

Below figures shows IEEE standard for voltage and current harmonics.

Table 5 IEEE standard for voltage harmonics as per IEEE 519

Low-voltage system classification and distortion limits			
	Special Applications[1]	General System	Dedicated system[2]
Notch Depth	10%	20%	50%
THD (voltage)	3%	5%	10%
Notch Area[3] (A_N)	16400	22800	36500
Note: The value A_N for other than 480 V systems should be multiplied by V/480 1. Special applications include hospitals and airports 2. A dedicated system is exclusively dedicated to the converter load 3. In volt-microseconds at rated voltage and current			

Table 6 IEEE standard for current harmonics as per IEEE 519

Current Distortion Limits for General Distribution System (120 V through 69000V)
Maximum Harmonic Current Distortion in Percent of I_L

Individual Harmonic Order (Odd Harmonics)				
I_{SC}/I_L	≤11	11≤h≤17	17≤h≤23	TDD
<20*	4	2	1.5	5
20<50	7	3.5	2.5	8
50<100	10	4.5	4	12
100<1000	12	5.5	5	15
>1000	15	7	6	20
Where: I_{SC}= maximum shot circuit current at PCC I_L= maximum demand load current (fundamental frequency component) at PCC				

- As per described in above measurement and standard it is suggested to put harmonics filter for better quality of power. We had suggested vender for harmonics filter. Plant person called them for site visit and detail discussion. Initially plant person put harmonics filter only for transformer 13. It is suggested by vender that to eliminate harmonics losses install harmonic filter at load end and reduce harmonic generation in line, also put one harmonic filter at a transformer to reduce harmonic generation in grid. As above it is suggested that install Adv. Passive filters at distribution side. And put one active filter at transformer side.
- $I_{rms}= I_1(1+THD^2)^{0.5}$, where: I_1= Fundamental current, Above equation shows that reduction in harmonics is reduction in losses ($I_{rms}= I_1$, where: THD=0). Harmonics increase rms current for a load drown a fundamental current, also its increase in joule losses, not taking in the account but skin effect.

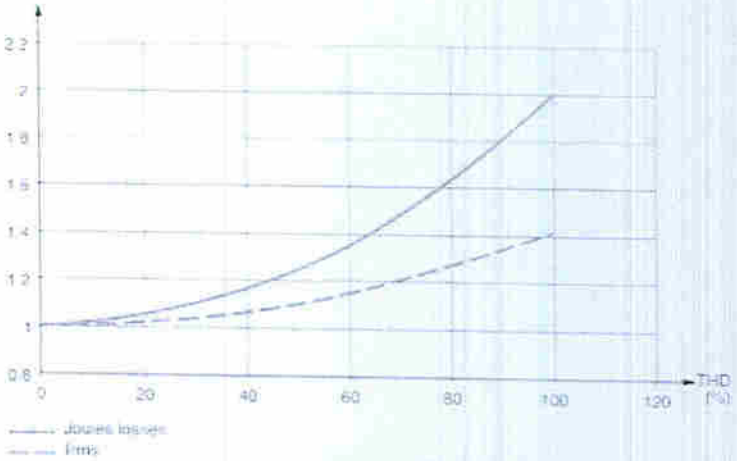


Figure 11 Harmonics losses

(The reference point in graph is 1 for I_{rms} and joules losses, the case when there are no harmonics)

Table 7 Harmonics Level on Transformer LT Side

Equipment	THD V % (Range)			THD I % (Range)		
	R	Y	B	R	Y	B
TRF	1.2-2	1.2-2	1.1-1.9	6.3-15	7.9-36.4	9.1-33.8

- Voltage harmonics (% total harmonic distortion) recorded at the transformer side is not within specified limits by ANSI Standard IEEE 519 - 1992 which is 3% of Voltage Harmonics and 5% whereas current harmonics. It is suggested to carry out a detailed harmonics study over a period of time such that THD is maintained within safe limits. A

typical study would record **3rd, 5th, 7th, 9th, 11th and higher currents Harmonics** to detect the source and suitable **Active or Passive filters** to suppress it.

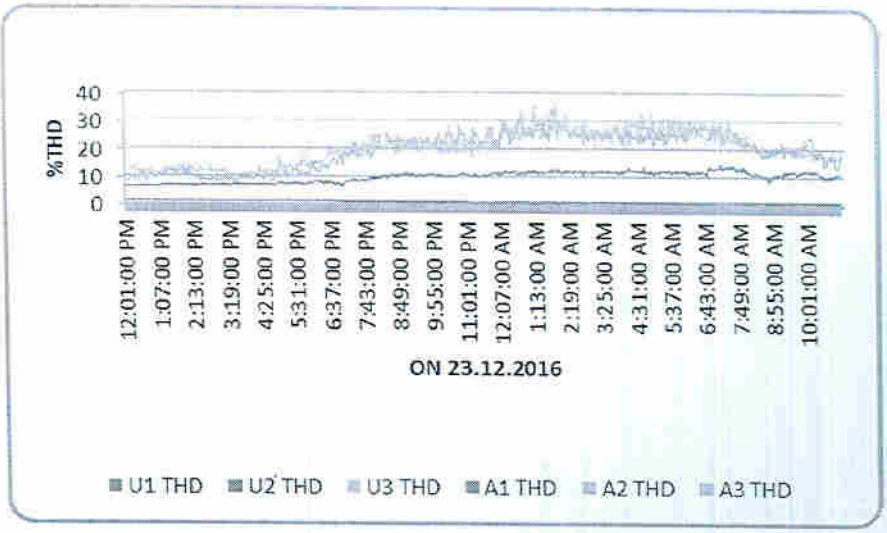


Figure 12 % THD at transformer in PUBs

Table 8 PCC/MCC Wise Harmonics Generation

Sr. No.	Identification	Volt	Amp.	KW	PF	%THD (V)	%THD (A)
Y - B	Bank Building	420	63.40	38.50	0.95	2.0	33.2
B - R	(O/G to 5A-1 bldg.)	406	63.30	35.50	0.78	1.9	40.6
R - Y		418	24.00	11.50	0.65	1.9	67.7
R-B	PMC	413	62.00	42.20	0.96	2.0	20.7
Y-B	(O/G to 5A-2 bldg.)	413	47.90	33.50	0.96	1.9	16.4
Y-R		414	55.60	42.70	0.93	1.9	24.4
R -Y	Custom Bldg.	414	60.00	42.60	0.89	2.0	33.7
Y-B	(O/G to 5B bldg.)	417	115.00	75.50	0.92	1.9	5.7
B-R		400	82.90	50.80	0.94	1.9	8.4
	RTCC	No load					
	APFC	No load					
Y - B	40 kVA UPS	422	16.80	12.20	1.00	2.0	117
B - R		420	16.00	11.50	1.00	1.9	113
R - Y		419	16.10	11.60	0.99	1.9	116
	DG ROOM LIGHTNING	No load					
PMC building							
R - Y	3rd floor MLDB Bldg.	419	20.50	14.60	-0.99	2.0	19.7
Y - B		420	8.49	6.17	1.00	1.8	11.5
B - R		419	6.25	4.53	1.00	2.1	47.6
R - Y	5 A 2 second floor	417	6.40	3.54	0.97	1.6	16.4
Y - B		418	6.79	4.86	0.99	2.5	6.3

Sr. No.	Identification	Volt	Amp.	KW	PF	%THD (V)	%THD (A)
B - R		419	3.26	2.34	0.99	3.1	10.2
R - Y	5A 2 Ground floor	417	11.60	8.30	0.99	2.1	21.3
Y - B		418	1.09	0.78	0.99	1.6	1.4
B - R		417	13.70	9.78	0.99	2.0	1.9
R - Y	5A 2 Forth floor	410	2.24	1.49	-0.94	2.0	54.8
Y - B		415	0.69	0.47	-0.95	1.5	3.9
B - R		417	14.10	10.07	-0.99	3.1	43.3
R - Y	5A 2 area common light	391	4.74	3.13	0.97	2.2	3.8
Y - B		395	22.30	15.09	0.99	1.9	20.2
B - R							
R - Y	AC UPS/SERVER ROOM	418	27.40	14.10	0.71	2.1	1.3
Y - B		410	13.40	2.85	0.65	1.6	5.0
B - R		415	4.18	2.10	0.70	1.3	4.3

3.4 UPS SYSTEM

- PMC buildings has 3 UPS of different capacity installed for providing back up and emergency power to data centre and server rooms.
- The VFI topology is more commonly known as double-conversion or "online" UPS, where in normal operation, the rectifier/inverter circuits are online and engaged. Power is converted from ac to dc in the rectifier and then from dc back to ac in the inverter. Additionally, dc power is used to charge the stored-energy medium under normal operation, and draw power from the stored-energy medium during a power outage. Different technologies can be used for the stored-energy medium including batteries and flywheels. Double-conversion UPS systems are also equipped with a static bypass path that bypasses the rectifier/inverter circuit during a fault condition.

- The installation and operating details are as mentioned bellow:

Table 9 UPS Installation Details

Sr. No	Location	ID	Rating in KVA	Make	Battery	Technology
1	PMC Bldg.	UPS 1	80	Synergy 3300	Lead Acid	On Line
2	PMC Bldg.	UPS 2	80	Synergy 3300	Lead Acid	On Line
3	Custom Bldg.	UPS 1	40	LN 3300	Lead Acid	On Line
4	Custom Bldg.	UPS 2	40	LN 3300	Lead Acid	On Line

3.4.1 Performance Details

Table 10 PMC building 80 kVA UPS 1

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
UPS Input	R	411	17	11.7	0.99	11.8					3.88	90.7
	Y	403	12.5	9.16	0.99	9.3					3.46	89.4
	B	407	13.7	9.22	1	9.2					3.5	89.7
UPS Output	R	396	10.1	9.77	-0.84	11.6	0	0.994 charging Amp	412	50	1.9	44.6
	Y	403	14.8	10.00	-0.94	10.6	0				2.1	39.7
	B	401	6.89	4.29	-0.87	4.9	0				1.88	45.1

Table 11 PMC building 80 kVA UPS 2

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	418	16.3	11.7	1.00	11.7					1.89	82.3
	Y	422	13	9.41	0.98	9.6					1.9	80.6
	B	420	14.6	10.6	1	10.6					1.87	82.1
UPS Output	R	398	8.88	6.01	-0.98	6.1	0	0.715 charging Amp	412	50	1.25	82.4
	Y	403	8.2	5.69	0.99	5.7	0				1.22	79
	B	400	6.61	5.31	1.00	5.3	0				3.97	95.9

Table 12 Customs Building 40 kVA UPS 1

Parameters		V	I	KW	PF	KVA	By pass	Charge (%)	Battery voltage	Frequency (Hz)	V THD %	A THD %
Input UPS	R	421	19.3	13.9	0.99	14.0					2.09	77.8
	Y	425	18	13.0	0.98	13.3					2.11	78.4
	B	423	17.8	14.0	1.00	14.0					2.14	77.2
UPS Output	R	394	5.72	3.51	-0.90	3.9	0	100	409.4	50	5.94	56.6
	Y	395	17.4	11.5	-0.97	11.9	0				5.24	55.1
	B	402	13.1	8.74	-0.96	9.1	0				5.62	52.9

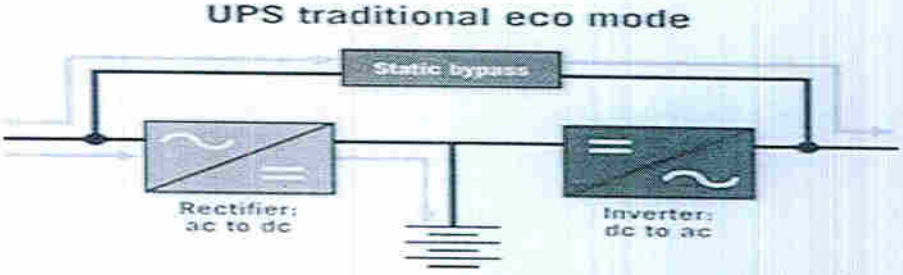
Location	Tag	Input kW	Output kW	% conversion efficiency
PMC building	UPS 1	30.08	24.47	81.35
PMC building	UPS 2	31.71	17.30	54.57
Custom building	UPS 1	Off		
Customs building	UPS 2	40.90	23.75	58.07

Observations

- UPS 1 of custom buildings was disconnected due to under maintenance.
- UPS rooms for PMC building are installed in air conditioned room where the room temperature is maintained between 22 to 25 °C and 50 to 60 % RH.
- From the % loading of each UPS of PMC building it is observed that the UPS are operated below 50 % load for 80 kVA capacity.
- % conversion efficiency of UPS 2 of OMC building and UPS 2 of Customs building is observed to be 54.5 and 58.07 % respectively which is well below the standard operating efficiency. It is recommended to replace UPS with energy efficient UPS.

Traditional eco mode

- In the traditional or classic eco mode, the load is normally powered through the bypass path, exposing the critical load to the raw utility power without conditioning, similar to the VFD topology (see Figure 2). The inverter is in standby and only engaged when the utility fails. Because of this, the losses in the rectifier and inverter are eliminated, making the UPS system more efficient.



- The average static double-conversion UPS system operates between 90% efficient at 30% load to about 94% efficient at 100% load. The efficiency percentage can go up or down a little depending on the technology used, and whether the UPS contains an input isolation transformer. With the elimination of the rectifier and inverter losses, the efficiency of the UPS system in eco mode can increase to 98% or 99%. In a 2N redundant-type (system + system) configuration, where the system is typically operating each UPS below 40%, that equates to about a 4% to 8% increase in efficiency. The increase in efficiency also means less heat, which reduces cooling requirements. The Green Grid estimates an average improvement of approximately 0.06 in PUE when going from double-conversion to eco mode.

Table 13 Energy Losses comparison in UPS

Location	Tag	Input kW	Output kW	%Load	efficiency	Losses	Losses at 90% efficiency
PMC Building	UPS 2	31.71	17.3	22	55	14.4	3.171
Custom	UPS 2	40.9	23.75	59	58	17.2	4.09
Power Losses per hour						31.6	7.3
Power Savings per hour							24.3

Table 14 Energy Saving by replacing existing UPS with Energy Efficienct UPS

Sr. No.	Description	Unit	Value
1	Working Hours/year	Hr.	8640
2	Unit rate in Rs.	Rs.	7.4
3	Saving unit in year	kW	209943
4	Saving Rs. in year	Rs. In Lac	15.54
5	Investment for New High efficiency UPS	Rs. In Lac	25
6	Payback in months	month	19

3.5 DG SET

3.5.1 Installation Details

1 DG set of 750 kVA is installed in the premises of PUB, PMC and Customs buildings. DG set is working only during the power Cut off through MUPL. Installation details are as mentioned in below table:

Table 15 DG installation details

Particulars	DG1
Make	Cummins India Ltd.
Location	PUB Building premise
Rated kVA	500
rpm	1500
Engine no.	6082611
Amp	696
pf	0.8
Excitation volt	48
Running hours	1342
Volt	415
Make(generator)	Stamford

3.5.2 Operation and performance details

Table 16 operation and performance details of DG set

Sr. No.	Description	Units	Value
1	Starting energy meter reading	kWh	974
2	Ending energy meter reading	kWh	1008
3	Start fuel tank reading	ltr	664
4	End fuel tank reading	ltr	654
5	Specific Fuel Consumption	ltr/kWh	0.294
6	Generating Electricity	kWh	34
7	Fuel used	ltr	10
8	Capacity of DG set	kVA	500
9	Operating Power factor	PF	0.8

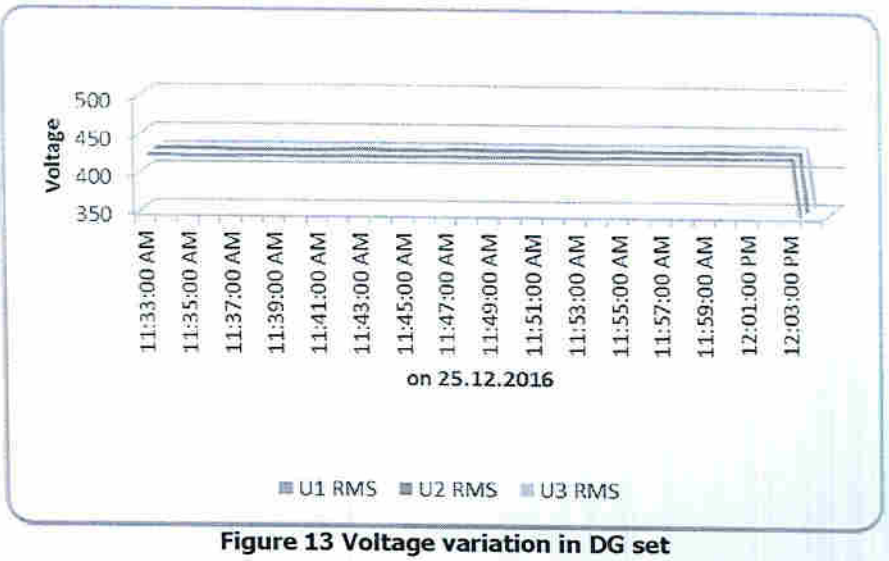


Figure 13 Voltage variation in DG set

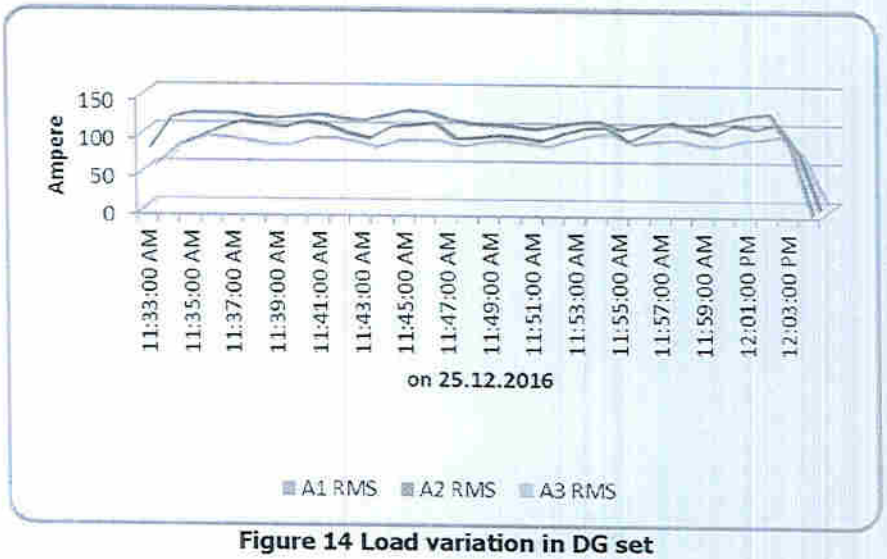


Figure 14 Load variation in DG set

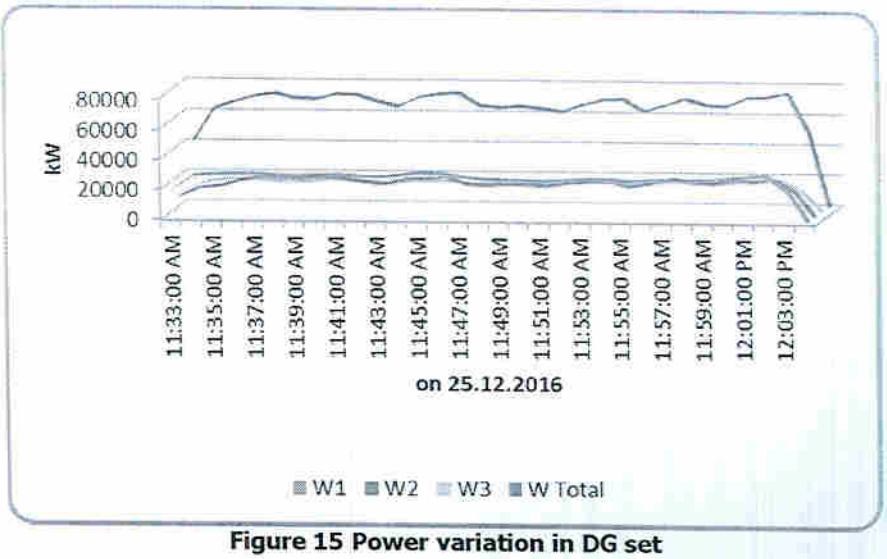


Figure 15 Power variation in DG set

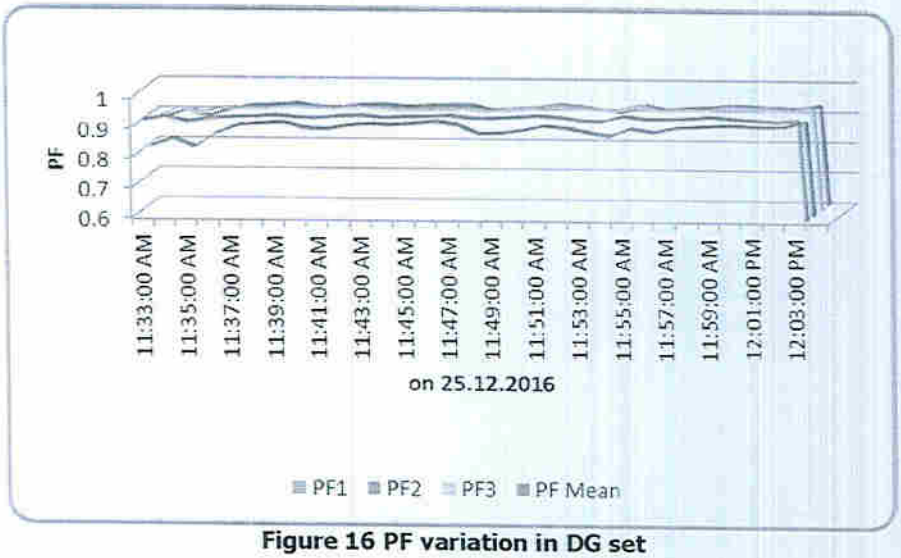


Figure 16 PF variation in DG set

➢ **Energy Saving Measures for DG Set:-**

- The basis for an apprehension that the DG set may get over loaded due to the fact that the current delivered by the DG set is generally considered as the indicator of output by most DG set users. It is well known that use of capacitors will reduce the current drawn from the DG set and could thus tempt the user to add more loads on a given DG set. The other reason for such an opinion is related to the risks arising due to sustained leading power factor conditions that would occur with the use of fixed capacitors in variable load situations. The ill effects of leading power factor on the behaviour of the DG sets are well recognized.
- Technological developments in the recent years have, however, resulted in development of suitable capacitor based REACTIVE POWER COMPENSATION (RPC) Systems which are capable of being used along with DG sets in a reliable and safe manner.

- It is also observed that judicious application of this modern technology can improve the overall efficiency of DG set operation and result in considerable economic benefits to the DG set user.
- Ensure steady load conditions on the DG Set , and provide cold dust free air at intake (use of air washers for large sets, in case of dry, hot weather can be considered)
- Improve air filtration.
- Ensure fuel oil storage, handling and preparation as per manufacturers guidelines.
- Consider fuel oil additives in case they benefit fuel oil properties for DG set usage.
- Calibrate fuel injection pump Frequently.
- Ensure compliance with maintenance check list.
- In case of a base load operation consider waste heat recovery system adoption for steam generation or refrigeration chiller unit incorporation.
- In terms of fuel cost economy consider partial use of biomass gas for generation ensure tar removal from the gas for improving availability of the engine in the long run.
- Carry out regular field trials to monitor DG set performance and maintenance planning as per requirements.

3.6 Package Air Conditioners (PAC)

3.6.1 Installation, operation and performance details of PAC system

There are 1 nos. of Emerson make Package AC Installed in Ground floor of PUB in UPS room, Installation, operation and performance details of PAC system are described below:

Table 17 Installation and operating parameters of PAC

Sr. No.	Parameters	Unit	PUB Building
1	Location	PAC	Ground floor Server room
2	Type		Downflow
3	Make		Emerson pex 120
4	model		Pex 125 FA-100
Measurement At Indoor Units:			
5	Suction Area Of The AHU	m^2	0.5625
6	Average Suction Velocity At AHU	m/sec	2.8
7	Density Of Air	Kg/m^3	1.164
8	Volume Of Air Actually Sucked By the AHU	m^3	5670
9	Mass Of Air At Inlet	Kg/hr	6599.88
10	Damper Position	%	
Suction Air Data At Inlet To AHU			
11	Air Inlet Temperature (DBT)	°C	28
12	Air Inlet Temperature (WBT)	°C	17
13	Inlet Air enthalpy	Kcal/Kg	11.3
14	Relative Humidity At Inlet	%	32.23
15	Moisture Content At Inlet	Kg/Kg of Air	0.0075
16	Total water Content at Inlet	Kg	49.4991
17	Total enthalpy At Inlet Air	Kcal	74578.644
Discharge Air data At Ducts:			
18	Air Outlet Temperature (DBT)	°C	22.6
19	Air Outlet Temperature (WBT)	°C	13.5
20	Outlet Air Enthalpy	Kcal/Kg	9.02
21	Relative Humidity At Outlet	%	35.1
22	Moisture Content At Outlet	Kg/Kg of Air	0.0059
23	Total water Content at Outlet	Kg	38.939
24	Total enthalpy At Outlet Air	Kcal	59530.9
Actual Performance:			
26	Enthalpy Removed From Air	Kcal	15047.73
27	Total water Evaporated	Kgs	10.5598
28	Enthalpy Of water Evaporation	Kcal	5691.74
29	Total Heat Removed	Kcal	20739.46

Sr. No.	Parameters	Unit	PUB Building
30	Actual Capacity	TR	6.85829
31	Actual Power Measured	KW	8.97
32	Specific Power Consumption (SPC)	KW/TR	1.31
33	Running Hr.		24 hours/day
35	Observations		2 UPS LOAD OF PUB Bldg. Observed in good working condition

Table 18 AC and ceiling fan installation details in 5A-2 PMC building

Sr. No.	Area	Sub Area	A.C - 1TR	A.C -1.5TR	Ceiling Fan (60 W)
1	Grd Floor	Waiting room		1	
2	1st Floor	Dredging Dept 101		2	
3	1st Floor	Office RHS 106	1		1
4	1st Floor	Office Cabin 106			2
5	2nd Floor	Rail Logistics 205		1	
6	2nd Floor	Electrical & Mechanical Room 206		1	
7	3rd Floor	IT Dept. 306	2		
8	Grd Floor	Dy. Comm Office 01		1	
9	Grd Floor	IRS Office 02		1	
10	Grd Floor	office 03		2	
11	Grd Floor	Import Section 04	2	1	
12	Grd Floor	Bond & EODC 05		4	
13	Grd Floor	UPS room 06		1	
14	Grd Floor	Elctrical Room 07			1
15	Grd Floor	Export Assess. 08		1	1
16	Grd Floor	MCD/legal 09			1
17	Grd Floor	CMC room 10			1
18	Grd Floor	IRS office 11		1	
19	Grd Floor	IRS office 12			
20	1st Floor	office 100		1	1
21	1st Floor	R & I section 101		1	1

Sr. No.	Area	Sub Area	A.C - 1TR	A.C -1.5TR	Ceiling Fan (60 W)
22	1st Floor	Pr. Comm office	3		
23	1st Floor	Server room 105		1	
24	1st Floor	Electrical & system room 106	2		
25	1st Floor	PCA Section 108			1
26	1st Floor	Drawback section 109	1		
27	1st Floor	office 110		1	
28	1st Floor	Apprising section 111		1	
29	1st Floor	IRS office 112			
30	1st Floor	IRS office 103		1	
31	1st Floor	IRS office 102		1	
32	2nd Floor	D. P Section 201		1	
33	2nd Floor	Estd. & admin 202		1	
34	2nd Floor	Acc section 203			1
35	2nd Floor	legal section 204		1	
36	2nd Floor	Document room		1	
37	2nd Floor	Special investigation room			1
38	2nd Floor	adjudiction section 208		1	1
39	2nd Floor	RRA section 211		1	
40	2nd Floor	Refund section			
41	3rd Floor	office 301		1	
42	3rd Floor	office 302		1	
43	3rd Floor	recovery cell 303			
44	3rd Floor	office 305		1	
45	3rd Floor	Adani bunkering 310		2	
46	4th Floor	Secretariat 404		2	
		Total	**11**	**37**	**13**

Table 19 Energy Saving Potential in Air conditioners and ceiling fans

for 1 ton									
EER		kwh	nos.	Working Hr./Annum	unit rate Rs.	Saving in Kwh	Saving in Rs./Annum	Investment in Rs.	Payback period in month
2 star	3	1.154	11	1440	7.6	2693	20465	330000	193
5 star	3.6	0.984							
		0.17							
for 1.5 ton									
EER		kwh	37	1440	7.6	15984	121478	1295000	128
2 star	2.9	1.7							
5 star	3.6	1.4							
		0.3							
Gorrila ceiling fan									
existing Wh		60	13	3240	7.6	1348	10244	31200	37
Proposed Wh		28							

Table 20 Technical Details of Gorilla Energy Efficient Fan

Parameter	Detail (Gorilla Energy Efficient Fan)
Span(mm/inch)	1200/48
Service Value/Air Delivery	>7
Input Voltage(V)	140-285
Power Consumption(W)	28
Frequency(Hz)	48-52
Air Delivery(CMM)	220
Power Factor	0.95
No. of Blades	3
Bearing	Deep Groove Double Sided Steel Shielding
Remote Control (10 Keys)	Speed Control, Timer and Sleep Mode
Guarantee	3 Years

3.7 LIGHTING SYSTEM

3.7.1 Lux measurement of different Indoor fittings

Based on different type of fixtures in PUB, PMC & Customs building, power measurement was taken from which calculation of power consumed/ fixture is calculated. Average lux of minimum 6 points to maximum of 16 points as per area has been taken in the calculation.

Location	Sub location	Luminary	Fixtures Turn on	Rated Power (kW)	Measured Power (W)	Measured Power/ luminary	Average Lux at working plane
Adani House Ground Floor	Reception and corridor	CFL warm white	16	18	298	18.625	192
Adani House First Floor	Staff room LHS	LED Ceiling Tile	28	36	1024	36.569	284
Adani House Ground Floor	Staff office	FTL	24	36	890	37.083	303
Adani House Ground Floor	Bridge light Foyer	T-5	9	40	368	40.889	210

3.7.2 Lighting Installation and lux measurement details

Lighting Installation details of all three building areas are mentioned in table below. Each working area has been studied for lux measurement, however closed offices/ areas are not measured during the study.

Table 21 PMC Building 5A-2 lighting Installation and lux measurement details

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
1	Grd Floor	Waiting room	CFL	3	18	Y	Y	Y	ballast	Main Board GF	1	with	147	9	
2	Grd Floor	Waiting room	T-5	4	36	Y	Y	Y	choke		2	with	147	9	
3	Grd Floor	Restaurant	T-5	20	40	N	Y	Y	choke		2	w/o	1755	14	NLA
4	1st Floor	Dredging Dept 101	FTL	18	36	Y	Y	N	choke	Main Board	2	with	281	9	NAS

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
5	1st Floor	Dredging Dept 102	FTL	18	36	Y	Y	N	choke	1stF	2	with	173	9	NAS
6	1st Floor	Conference room 103	FTL	8	36	Y	Y	N	choke		2	w/o	358	NA	VAC, NAS
7	1st Floor	Office LHS 106	FTL	8	36	Y	Y	N	choke		2	with	185	9	NAS
8	1st Floor	Office RHS 106	FTL	16	36	Y	Y	N	choke		2	with	170	9	NAS
9	1st Floor	Office Cabin 106	FTL	8	36	Y	Y	N	choke		2	with	316	NA	VAC
10	1st Floor	Pantry Room 107	FTL	4	36	Y	Y	N	choke		2	with	225	9	NAS
11	1st Floor	Dredging dept. 108	FTL	12	36	Y	Y	N	choke		2	with	172	9	
12	1st Floor	Cabin 108	FTL	4	36	Y	Y	N	choke		2	with	166	NA	VAC, NAS
13	2nd Floor	Const. Non marine 201	FTL	16	36	Y	Y	Y	choke	Main Board 2ndF	4	with	279	9	NAS
14	2nd Floor	Const. Non marine 202	FTL	20	36	Y	Y	Y	choke		5	with	294	9	NLA
15	2nd Floor	Conference room 204	FTL	8	36	Y	Y	N	choke		2	with	291	9	NBU
16	2nd Floor	Rail Logistics 205	FTL	8	36	Y	N	N	choke		4	with	214	9	NAS
17	2nd Floor	Electrical & Mechanical Room 206	FTL	14	36	Y	N	N	choke		2+4	with	215	9	NAS
18	3rd Floor	DCC Mundra office	FTL+CFL	2+2	36+18	Y	Y	Y	Choke + Ballast	Main Board 3rdF	2+2	with	371	NA	NLA
19	3rd Floor	Room 303	FTL+CFL	8+6	36+18	Y	Y	Y	Choke + Ballast		4+6	with	452	9	NBU
20	3rd Floor	PMC head Mundra Office	FTL+CFL	3+3	36+18	Y	Y	Y	Choke + Ballast		3+3	with	151	NA	NLA
21	3rd Floor	Survey Cell Eq. room	FTL+CFL	3+2	36+18	Y	Y	Y	Choke + Ballast		3+1	with	214	9	NAS
22	3rd Floor	IT Dept. 306	FTL	8	36	Y	Y	N	choke		2	with	182	9	NLA
23	3rd Floor	HR-Admin 307	FTL	2	36	Y	Y	Y	choke		1	with	192	9	NLA
24	4th Floor	Office 401	FTL	3	36	Y	Y	Y	choke		3	w/o	404		NLA

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
25	4th Floor	Planning & Engg 404	FTL+ LED	16+ 4	36+ 12	Y	Y	Y	Choke		4+ 2	with	324	9	NLA

Table 22 Customs Building 5B lighting Installation and lux measurement details

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
1	Grd Floor	Dy. Comm Office 01	FTL+ CFL	4+ 2	36+ 18	Y	Y	N	Choke + Ballast	Separate energy meter and boards for each office	2+ 2	with	354	9	NLA
2	Grd Floor	IRS Office 02	FTL+ CFL	4+ 2	36+ 18	Y	Y	N	Choke + Ballast		2+ 2	with	255	9	NLA
3	Grd Floor	office 03	FTL+ CFL	4+ 2	36+ 18	Y	Y	Y	Choke + Ballast		2+ 2	with	236	9	NLA
4	Grd Floor	Import Section 04	FTL	18	36	N	Y	N	choke		6	with	165	9	NBU
5	Grd Floor	Bond & EODC 05	FTL+ CFL	8+ 1	36+ 18	Y	Y	Y	Choke + Ballast		4+ 1	with	183	9	NLA
6	Grd Floor	UPS room 06	FTL	5	36	N	Y	Y	choke		1	with		24	UT, NOR
7	Grd Floor	Elctrical Room 07	T-5	16	40	N	Y	Y	choke		4	with	273	24	NOR
8	Grd Floor	Export Assess. 08	FTL	8	36	Y	Y	Y	choke		2	with	174	9	NLA
9	Grd Floor	MCD/legal 09	FTL+ CFL	8+ 18	36+ 18	Y	Y	Y	Choke + Ballast		4+ 6	with	261	9	
10	Grd Floor	CMC room 10	FTL	8	36	Y	Y	Y	choke		4	with	115	9	
11	Grd Floor	IRS office 11	FTL	2	36	Y	Y	Y	choke		1	with	185	9	
12	Grd Floor	IRS office 12	FTL	8	36	Y	Y	N	choke		4	with	229	9	NBU
13	1st Floor	office 100	FTL	2	36	Y	Y	N	choke	Separate energy meter and	1	with	145	9.	NBU
14	1st Floor	R & I section 101	FTL	2	36	Y	N	N	choke		1	with	106	9	major lights

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
										boards for each office					fused
15	1st Floor	Pr. Comm office	LED	6	36	N	Y	N			2	with	518	9	VAC
16	1st Floor	Server room 105	FTL+ CFL	8+ 2	36+ 18	Y	Y	Y	Choke + Ballast		2	with	228	24	NOR
17	1st Floor	Electrical & system room 106	FTL+ CFL	5+ 1	36+ 18	Y	N	Y	Choke + Ballast		2	with	154	24	UT, NOR
18	1st Floor	Room 107	T-5	5	40	N	Y	Y	choke		3	with	356	9	NLA
19	1st Floor	PCA Section 108	FTL	8	36	Y	Y	N	choke		4	with	223	9	NLA
20	1st Floor	Drawback section 109	FTL+ CFL	8+ 2	36+ 18	Y	Y	Y	Choke + Ballast		2	with	197	9	NAS
21	1st Floor	office 110	FTL+ CFL	5+ 1	36+ 18	Y	Y	Y	Choke + Ballast		3	with	161	9	NAS
22	1st Floor	Cash section	T-5	2	40	Y	Y	Y	choke		2	with	151	9	NAS
23	1st Floor	Apprising section 111	FTL	5	36	Y	Y	N	choke				172	9	NBU
24	1st Floor	IRS office 112	FTL	5	36	Y	Y	Y	choke		3	with	191	9	NLA
25	1st Floor	IRS office 103	FTL	8	36	Y	Y	Y	choke		4	with	318	9	NAS
26	1st Floor	IRS office 102	FTL+ CFL	8+ 2	36+ 18	Y	Y	N	Choke + Ballast		4+ 2	with	211	9	NAS
27	2nd Floor	D. P Section 201	FTL	5	36	Y	Y	Y	choke	Separate energy meter and boards for each office	5	with	212	9	NBU
28	2nd Floor	Estd. & admin 202	FTL	3	36	Y	Y	Y	choke		3	with	126	9	NBU
29	2nd Floor	Acc section 203	FTL	8	36	Y	Y	Y	choke		4	with	262	9	NLA
30	2nd Floor	legal section 204	FTL	2	36	Y	Y	Y	choke		2	with	212	9	NAS
31	2nd Floor	Dining room	FTL	5	36	Y	Y	Y	choke		5	with	314	14	NAS
32	2nd Floor	Document room	FTL	3	36	Y	Y	Y	choke		3	w/o	159	9	NLA
33	2nd Floor	Special investigation room	FTL	8	36	Y	Y	Y	choke		4	w/o	235	9	NLA

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
34	2nd Floor	adjudiction section 208	FTL	5	36	Y	Y	Y	choke		5	with	275	9	NAS
35	2nd Floor	office 205	FTL	8	36	Y	Y	Y	choke		4	with	163	9	NBU
36	2nd Floor	IRS office 209	FTL	8	36	Y	Y	Y	choke		4	with	427	9	NAS
37	2nd Floor	admin office 210	FTL	8	36	Y	Y	Y	choke		4	w/o	161	9	NLA
38	2nd Floor	RRA section 211	FTL	8	36	Y	Y	Y	choke		4	with	184	9	NLA
39	2nd Floor	Refund section	FTL	8	36	Y	Y	Y	choke		4	w/o	381	9	NLA
40	3rd Floor	office 301	FTL	8	36	Y	Y	Y	choke		4	with	285	9	NLA
41	3rd Floor	office 302	FTL	8	36	Y	Y	Y	choke	Separate energy meter and boards for each office	4	w/o	502	9	NLA
42	3rd Floor	recovery cell 303	FTL	8	36	Y	Y	Y	choke		4	w/o	591	9	NLA
43	3rd Floor	office 305	FTL	8	36	Y	Y	Y	choke		4	with	294	9	NLA
44	3rd Floor	office 308	FTL	8	36	Y	Y	Y	choke		4	with	333	9	NLA
45	3rd Floor	office 309	FTL	8	36	Y	Y	Y	choke		4	with	193	9	NLA
46	3rd Floor	Adani bunkering 310	CFL	8	40	Y	Y	N	choke		4	with	238	9	NBU
47	3rd Floor	Adani bunkering 311	CFL	17	40	Y	N	N	choke		8	with	138	9	NLA
48	3rd Floor	office 312	FTL	5	36	N	Y	Y	choke		5		366	9	VAC
49	3rd Floor	office 313	FTL	4	36	N	Y	Y	choke		4		183	9	NLA
50	4th Floor	Secretariat 404	FTL	24	36	Y	Y	N	choke	Separate energy meter and boards for each office					VAC
51	4th Floor	Station Medical office 406	FTL	8	36	Y	Y	Y	choke		4	w/o	309	NA	NOR
52	4th Floor	Operation centre 414	FTL	12	36	Y	Y	Y	choke		4	with	214	12	NLA
53	4th Floor	Ship's office 401	FTL	8	36	Y	Y	Y	choke		4	w/o	363	9	NLA
54	4th Floor	Gunnery section 402	FTL	8	36	Y	Y	Y	choke		4	w/o	349	9	NLA

Table 23 PUB Building 5A-1 lighting Installation and lux measurement details

Sr. No.	Area	Sub Area	Type of Luminary	Qty.	Watt/Luminary	Reflector Y/N	Natural Lighting Availability	Possibility of using Natural Lighting	Ignitor Type	Power Mention DB No.	Fixtures/ switch	Measurement. Condition	Average Measured Lux	Running Hours (Hr/day)	Remarks
1	Grd Floor	Post office 01	T-5	2	40	N	N	N	choke	Separate energy meters for each office	1	with	118	8	
2	3rd Floor	Taurus Shipping	FTL	8	36	Y	Y	Y	choke		4	w/o	127	9	NAS
3	3rd Floor	Darabshaw Cursetjee's pvt ltd.	FTL	4	36	Y	Y	Y	choke		2	with	141	9	NBU
4	3rd Floor	Aditya Marine	FTL	24	36	Y	Y	Y	choke		4	with	311	9	NAS
5	3rd Floor	Shivam 304	FTL	8	36	Y	Y	Y	choke		4	w/o	340	9	NLA
6	3rd Floor	MSC Agency 306	FTL	8	36	Y	Y	Y	choke		4	w/o	347	9	NLA
7	3rd Floor	Sujan Multiports Ltd	FTL	4	36	Y	Y	Y	choke		2	w/o	81	9	NLA
8	4th Floor	office 401	FTL	8	36	Y	Y	Y	choke		4	with	308	9	NAS
9	4th Floor	office 403	LED	2	36	N	N	N			1	with	366	9	
10	4th Floor	IRS Office 404	FTL	2	36	Y	Y	Y	choke		1	with	406	9	NBU
11	4th Floor	office 405	FTL	2	36	Y	Y	Y	choke		1	w/o	201	9	NLA
12	4th Floor	Appraiser & POS 408	CFL	12	18	Y	Y	Y	choke		3	with	292	9	NAS

Table 24 Summary of lighting fixtures

Fixture	Power (W)	Building		
		5A-1	5A-2	5B
CFL	18	12	16	57
FTL	36	68	207	337
LED	12	2	4	6
T-5	40	2	0	23
Total	(kW)	2.8	7.8	14.15

Table 25 Energy Saving by replacing FTL with LED

Location	Luminary	Running Hours	Qty	Existing power consumption	Action	Potential Power Saving

		Hr.		W		kWh/year
5A-1	FTL	2700	68	36	Replace with single 15 W LED	3856
5A-2	FTL	2700	207	36	Replace with 15 W LED	11737
5B	FTL	2700	337	36	Replace with 15 W LED	19108
	Total		612			
Total Power Saving Potential						34700
Saving in cost in Rs.						263723
Total 15 W LED proposed @Rs. 1000						612000
Simple payback in Month						28

Table 26 Remarks Legend

Abbreviation	Full Form
NOR	Non occupancy Room
VAC	Room vacant/unused during audit
UT	Utility room, open during non-office hours
NBU	Natural Lighting Available but not utilising, window is curtained
NAS	Natural Lighting Utilising but not sufficient due to sun film
NLA	Natural Lighting Available and utilising
SF	Window in coated with non-reflective sun films
OC	Occupancy sensors installed

3.7.3 Lighting Power

- Based on instantaneous power measured during the time of audit at peak occupancy hours the lighting power was measured individual panel wise that is located on electrical room of each floor. The total power calculated is as shown in below table:

Table 27 Lighting power DB wise

Location	Tag	Phase	V	I	kW	PF	Sub total
5A-2	PMC building						kW
Ground Floor	NA	RN	240	1.29	0.293	-0.98	1.02
		YN	241	2.61	0.402	0.63	
		BN	243	1.4	0.32	-0.95	
1st Floor	NA	RN	242	1.9	0.41	0.89	2.42
		YN	243	2.14	0.49	-0.94	
		BN	241	6.4	1.52	-0.99	
2nd Floor	NA	RN	240	3.02	0.71	-0.98	2.46
		YN	242	7.66	1.6	0.86	
		BN	244	0.64	0.15	0.99	
3rd Floor	NA	RN	240	5.1	1.2	-0.99	2.43
		YN	242	4.74	1.05	0.91	
		BN	245	0.93	0.18	-0.8	

4th Floor	NA	RN	240	0.2	0.048	0.99	0.33
		YN	241	0.34	0.079	-0.96	
		BN	242	0.98	0.2	0.87	
Total	**kW**						**8.65**
Note: 5A-1 & 5B building are commercial buildings and each office has its own energy meter. No separate lighting DB is allotted floor wise. Only 1-phase connections are given to each office.							

Table 28 Saving with AVC in PUB Building

Sr. No.	Particulars	Values	Unit
1	Measured Lighting load PUB Building during day time	25.0	kW
2	Present Average Voltage at Receiving End (V1)	240	V 1-ph
3	Proposed Operating Voltage after Installing AVC (V2)	230	V 1-ph
4	Power (P1)	V^2/R	
5	Power (P2)	$P1(V2/V1)^2$	
	day time	23.0	kW
6	Power Savings at Present Lighting Load	2.0	kW
7	Total Annual Operating Time day and night	4320	hr
8	Total Saving Potential	8812	kW
9	Total Savings Potential	65213	Rs. @ 7.4 Rs./kWh
10	Investment of installing AVC (30 kW)	1.0	Rs. Lakh
11	Simple Payback Period	18	month

➢ Intangible Areas of Energy conservation Opportunity at PUB :

➢ Replacement with Inverter ACs

Digital Inverter technology maintains precise control of room temperature and creates a comfortable environment. In conventional split Air Conditioners, the compressor switches off once the set temperature is reached, and switches on again after temperature drops. The time it takes for the Split Air Conditioner to switch on and off causes the room temperature to greatly fluctuate. With Digital Inverter, the inverter control reduces the compressor power once the desired temperature has been reached, but continues operating at a reduced state to maintain a stable room temperature with minimal fluctuations. By putting an end to on/off compressor operation, the inverter technology also allows Digital Inverter to significantly reduce noise levels; Superior reliability has been achieved, due to the reduction of the compressor ON/OFF cycles. Digital DC Inverter Air Conditioners provide this benefit to consumers, helping them to

achieve various benefits such as saving of at least 25% of their energy costs. These air conditioners are much quieter and offer higher levels of efficiency as their noisier counterparts. The average AC power consumption as recorded during winter (present time) is about 54.71 KW. This is likely to be 30 to 35% higher during hot season. The average consumption could be put at 60 KW/month over year. The power savings with digital inverter type AC units would at 20% would be 12 KW/month. The annual energy conservation potential of this intervention is: 94,000 kWh/year.

- **Incorporating Evaporative Air Cooling**

Dry Climates are ideally suitable for Evaporative Cooling. Double circuit evaporative cooling would be worth looking into, contingent upon availability of water and space. An evaporative cooler produces effective cooling by combining a natural process - water evaporation - with a simple, reliable air-moving system. Fresh outside air is pulled through moist pads where it is cooled by evaporation and circulated through a house or building by a large blower. As this happens, the temperature of the outside air can be lowered as much as 30 degrees. This technology can provide significant savings relative to conventional electric compressor-based AC systems in areas with low humidity. Furthermore, this system will drastically improve air quality for and occupational health of kitchen and office staff since these systems do not recirculate air unlike Air Conditioning systems. Incidences of building-sickness with these systems will be largely eliminated and will improve overall workforce productivity. Evaporative Cooling comes at 40% lesser cost compared to refrigerant based cooling.

- **Direct Evaporative Water Spraying Technology**

This technology essentially comprises of spraying water on exterior building walls to reduce the temperature of the interior environment and thereby reducing Air Conditioning load and increasing operational energy efficiency of the built space. While this system does increase water consumption and the associated energy for pumping, these impacts might be mitigated by utilizing the grey water recycled or stored harvested rain water from the building rooftop during the wet months and putting it to use in the dry months. This technology is not expected to yield significant benefit in humid climates or seasons. Also, the paint selection for building exteriors must account for the increased fungal growth potential due to increased surface moisture – and hence must have strong anti-fungal properties.

- **Overhaul of Refrigerant Piping Insulation & Filter Maintenance**

The Gas pipe insulation was found to be damaged at various points on the AC units. Mending / replacement of insulation would improve the performance of AC units. Cleaning of filters of all indoor units and cleaning of condenser fins by jet pumps. Average life of typical Split Units is considered to be 10 years in dry climates without corrosive pollutants.

- **Optimal AC Temperature Setting**

Using all Units at Specific Set Points can greatly reduce HVAC energy consumption. It was observed that the set-point for ACs was generally at 190 C in the Bank Branch. All AC units may be set at 23/24 ^{0}C for optimum power consumption. The annual energy conservation potential of this intervention is: 28,500 kWh/year

➢ **Enhanced Use of Natural Lighting**

- Natural lighting available at the premises through the existing glass facades needs to be exploited to reduce the lighting load exerted. Currently, most of the glass facades are shielded using vertical-blinds and artificial lighting is used even in areas in the vicinity of glass panes.
  This intervention has the twin beneficial impact of reducing manufacturing related LCA impacts of lighting fixtures as well as reduced energy consumption. Some green architecture guidelines specify design lighting loads in the vicinity of 7.5 W/sq.m. For building occupancy of 10 hours/day, the average annual electricity conservation and GHG emissions mitigation per sq. m of naturally lit space relative to conventionally lit space is estimated to be 27 kWh/sq.m and 24 kgCO2e/sq. m.

➢ **Building-Envelope & Air-Conditioned Space Insulation**

- Weather-Stripping of All Doors, especially the main entrance doors into all building cavities.
  Use of Air curtain on Ground Floor Entrance to curtail infiltration losses: Frequenting clients on Ground Floor through main entrance incurs losses due to infiltration. These could be curtailed using Air Curtains. The advantage would be more prominent during summer

➢ **Solar-Heat Gain Reduction**

- Double-Glazed Panes and Spectrally-Selective Window Films
  Double and Triple-Glazed Windows enhance the insulation properties and reduce the operational energy requirement of the buildings. The advantage of these methods of insulation over other window systems which rely upon solar reflection (such as tinted and coated window films) is that they achieve heat gain reduction without greatly compromising visible light transmission. Solar reflection based systems, while achieving comparable heat gain reduction, are compromised by the increased interior lighting load necessitated by their application. Through Double and Triple Glazed Systems the heat gain/loss can be reduced by approximately 50% to 75% relative to Single Pane Glass Systems.

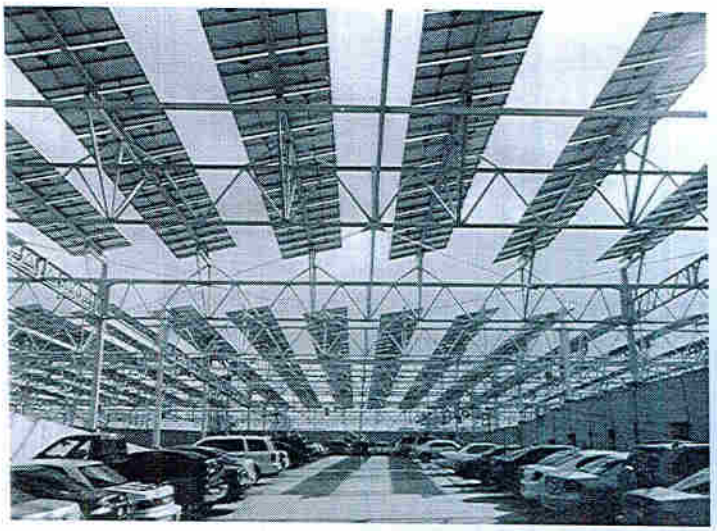
➢ **Heat Gain Reducing Paint**

- The Heat Gain Reducing Paint technology has the ability to reflect heat causing infrared rays from solar radiation. This intervention was designed to help reduce the internal temperature of the building i.e. reduce heat gain. Certification conducted by the Centre for Energy Studies and Research (CESR, India) indicates that Weather Shield Paints (i.e. solar reflective paints) can reduce the temperatures of walls by upto 50Cand that reflectivity rate for solar radiation through these paints is 0.40 relative to ordinary Currently, the MAIN DOOR of the entrance to the Branch has a significant air-gap between the frame and the door while all back-office doors meant to separate Air Conditioned Spaces from non-conditioned spaces are either missing or kept ajar at all times. exterior wall paint which exhibit a reflectivity rate of 0.21. i.e. these paints are approximately twice as effective in curbing building wall temperature rise due to solar radiation.

Renewable Power Feasibility at PUB :

- Plant first can install LED lights and then can install solar PV system so that requirement of project kW will be reduce.

Solar Panel Installation on Parking Shed



- Plant can use the parking space or another non utilize space with feasibility study of solar PV panel installation.

Advantages of Water Percolation and Water Harvesting:

Rainwater harvesting is collecting the run-off from a structure or other impervious surface in order to store it for later use. Traditionally, this involves harvesting the rain from a roof. The rain will collect in gutters that channel the water into downspouts and then into some sort of storage vessel. Rainwater collection systems can be as simple as collecting rain in a rain barrel or as elaborate as harvesting rainwater into large cisterns to supply your entire household demand.

The idea of rainwater harvesting usually conjures up images of an old farm cistern or thoughts of developing countries. The reality is that rainwater harvesting is becoming a viable alternative for supplying our households and businesses with water. It's not just for the farm anymore! There are many countries such as Germany and Australia where rainwater harvesting is a norm. Due to the green building movement, you will be seeing rainwater harvesting systems become more popular here in America.

The collection of rainwater is known by many names throughout the world. It ranges from rainwater collection to rainwater harvesting to rainwater catchment. In addition, terms such as roof water collection or rooftop water collection is also used in other countries.

We believe that rainwater harvesting is a viable technology in an urban setting. All that is necessary to take advantage of this resource is to capture the free water falling on your roof and direct it to a rainwater storage tank. By doing this, you can take control of your water supply and replace all or at least a substantial portion of your water needs. Rainwater harvesting systems can be configured to supply your whole house and/or your landscape needs.

What are the benefits of rainwater collection?

- Rainwater is a relatively clean and absolutely free source of water
- You have total control over your water supply (ideal for cities with water restrictions)
- It is socially acceptable and environmentally responsible
- It promotes self-sufficiency and helps conserve water
- Rainwater is better for landscape plants and gardens because it is not chlorinated
- It reduces storm water runoff from homes and businesses
- It can solve the drainage problems on your property while providing you with free water
- It uses simple technologies that are inexpensive and easy to maintain
- It can be used as a main source of water or as a back up source to wells and municipal water
- The system can be easily retrofitted to an existing structure or built during new home construction
- System are very flexible and can be modular in nature, allowing expansion, reconfiguration, or relocation, if necessary
- It can provide an excellent back-up source of water for emergencies

What Are The Uses Of Collected Rainwater

You can essentially use rainwater anywhere you use tap water. The idea of using drinking water to flush our toilets and water our lawns is wasteful and irresponsible, especially in light of population growth and water shortages across the country. Rainwater collection is a technique to green your home and to lessen your environmental footprint.

There are basically three areas where rainwater can be used:

- Irrigation use
- Indoor, non-potable use
- Whole house, potable use

Here are some ideas for specific uses of rainwater:

- Hand water your lawn and garden
- Connect rainwater collection system to irrigation/sprinkler system
- Wash your vehicles
- Wash your pets
- Refill your fountains and fish ponds
- Refill your swimming pool
- Replace the use of tap water with rainwater to wash your driveways and sidewalks (if you don't use a broom)
- Use it for all indoor non-potable fixtures (toilets and clothes washer)
- Use it for all potable needs when properly filtered and disinfected
- Use it for industrial processes instead of municipally treated water

How Much Rain Can I Collect ?

The amount of rainfall that you can collect is governed by the following formula:

1" of rain x 1 sq. ft. = 0.623 gallons

Or put in an easy form to remember :

1" of rain from 1,000 sq. ft. will provide 623 gallons

To calculate the amount of rainwater you can collect, you need to know your annual average precipitation for your area.

Water Percolation:

In this method rain water collected from the roof of the building is diverted to a storage tank. The storage tank has to be designed according to the water requirements, rainfall and catchment availability. Each drainpipe should have mesh filter at mouth and first flush device followed by filtration system before connecting to the storage tank. It is advisable that each tank should have excess water over flow system.

In this method rain water collected from the roof of the building is diverted to a storage tank. The storage tank has to be designed according to the water requirements, rainfall and catchment availability. Each drainpipe should have mesh filter at mouth and first flush device followed by filtration system before connecting to the storage tank. It is advisable that each tank should have excess water over flow system.

Ground water aquifers can be recharged by various kinds of structures to ensure percolation of rainwater in the ground instead of draining away from the surface. Commonly used recharging methods are:-

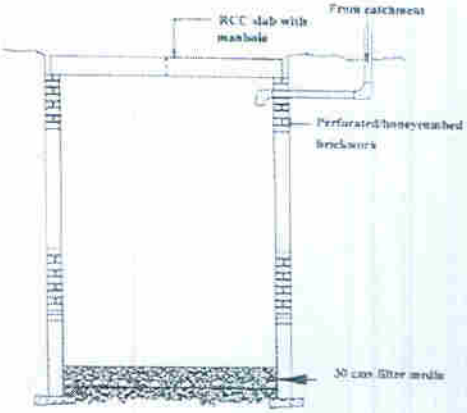
a) Recharging of bore wells
b) Recharging of dug wells.
c) Recharge pits

d) Recharge Trenches
e) Soak ways or Recharge Shafts
f) Percolation Tanks

Recharging of bore wells

Rainwater collected from rooftop of the building is diverted through drainpipes to settlement or filtration tank. After settlement filtered water is diverted to bore wells to recharge deep aquifers. Abandoned bore wells can also be used for recharge.

Optimum capacity of settlement tank/filtration tank can be designed on the basis of area of catchment, intensity of rainfall and recharge rate as discussed in design parameters. While recharging, entry of floating matter and silt should be restricted because it may clog the recharge structure. "first one or two shower should be flushed out through rain separator to avoid contamination. This is very important, and all care should be taken to ensure that this has been done."



Typical recharge pit

- Roof or terraces uses for harvesting should be clean, free from dust, algal plants etc.
- Roof should not be painted since most paints contain toxic substances and may peel off.
- Do not store chemicals, rusting iron, manure or detergent on the roof.
- Nesting of birds on the roof should be prevented.
- Terraces should not be used for toilets either by human beings or by pets.
- Provide gratings at mouth of each drainpipe on terraces to trap leaves debris and floating materials.
- Provision of first rain separator should be made to flush off first rains.
- Do not use polluted water to recharge ground water.
- Ground water should only be recharged by rainwater.
- Before recharging, suitable arrangements of filtering should be provided.
- Filter media should be cleaned before every monsoon season.
- During rainy season, the whole system (roof catchment, pipes, screens, first flush, filters, and tanks) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.
- At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed off all sediments and debris

Appendix - I

ELECTRICITY BILL

APPENDIX – I

ELECTRICITY BILL

CONSUMER NO: 200008 & 200033

MUPL

Month	Dec-15	Jan-16	Feb-16	Mar-16	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16
Contract Demand (KVA)	900	900	900	900	900	900	900	900	900	400	400	400
85 % Billing Demand (KVA)	765	765	765	765	765	765	765	765	765	340	340	340
Billing Demand (KW)	765	765	765	824	895	900	900	900	883.5	346.5	383.5	340
Actual Demand (KVA)	517	508	580	832	904	1069	1052	1008	892	385	395	319
Average PF (%)	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.900	0.97	0.900
Total Unit Consumption (Kwh)	197770	186010	189520	258350	291560	361020	364040	311820	280120	125650	109760	83835
TOU Units (Kwh)	65924	62003	63173	86117	97187	120340	121346	103940	93374	41880	36590	27945
Fixed Charges (Rs.)	626076	626076	585684	674361.6	708840	736560	712800	736560	723056.4	274428	213993	183600
EXCESS Demand Charges (Rs.)	0	0	0	0	4276.8	186718	162518.4	119322.7	0	0	0	0
Energy Charges (Rs.)	702083.5	660335.5	672796	917142.5	1020460	1263570	1274140	1091370	980420	439775	340256	259888.5
Load factor (%)	53.1	50.9	45.4	43.1	44.8	46.9	48.1	43.0	43.6	45.3	38.6	36.5
FPPPA Charges (Rs.)	166126.8	174849	238795	325521	367366	454885.2	458690.4	280638	252108	113085	71344	54492.75
PF Adjustment Charges (Rs.)	-3619.19	-3403.98	-3468.2	-4727.8	-5335.4	-6606.66	-6661.92	-5706.3	-5126.19	0	-1415.9	0
Meter Rent (Rs.)	750	750	750	750	750	750	750	750	750	750	750	750
Electricity Duty (Rs.)	0	0	0	0	0	0	0	0	487614.55	206822	156044.27	124495.31
Total Bill (Rs.)	1491417	1458607	1494557	1913047.3	2096357	2635877	2602237	2222934	2438823	1034860	780971	623227

Appendix -II
MONTHLY FUEL & WATER CONSUMPTION

APPENDIX- II

FUEL CONSUMPTION

- Monthly Diesel Consumption

Sr. No	Month	Diesel Consumption in (Ltr)
1	Dec-15	80
2	Jan-16	490
3	Feb-16	40
4	Mar-16	230
5	Apr-16	30
6	May-16	50
7	Jun-16	50
8	Jul-16	110
9	Aug-16	130
10	Sep-16	270
11	Oct-16	20
12	Nov-16	10
	Total	1510

Appendix -III
MCC/PCC LOADING

MCC/PCC Loading

Sr. No.	Identification	Volt	Amp.	KW	PF	%THD (V)	%THD (A)
Y - B	Bank Building	420	63.40	38.50	0.95	2.0	33.2
B - R	(O/G to 5A-1 bldg.)	406	63.30	35.50	0.78	1.9	40.6
R - Y		418	24.00	11.50	0.65	1.9	67.7
R-B	PMC	413	62.00	42.20	0.96	2.0	20.7
Y-B	(O/G to 5A-2 bldg.)	413	47.90	33.50	0.96	1.9	16.4
Y-R		414	55.60	42.70	0.93	1.9	24.4
R -Y	Custom Bldg.	414	60.00	42.60	0.89	2.0	33.7
Y-B	(O/G to 5B bldg.)	417	115.00	75.50	0.92	1.9	5.7
B-R		400	82.90	50.80	0.94	1.9	8.4
	RTCC	No load					
	APFC	No load					
Y - B	40 kVA UPS	422	16.80	12.20	1.00	2.0	117
B - R		420	16.00	11.50	1.00	1.9	113
R - Y		419	16.10	11.60	0.99	1.9	116
	DG ROOM LIGHTNING	No load					
PMC building							
R - Y	3rd floor MLDB Bldg.	419	20.50	14.60	-0.99	2.0	19.7
Y - B		420	8.49	6.17	1.00	1.8	11.5
B - R		419	6.25	4.53	1.00	2.1	47.6
R - Y	5 A 2 second floor	417	6.40	3.54	0.97	1.6	16.4
Y - B		418	6.79	4.86	0.99	2.5	6.3
B - R		419	3.26	2.34	0.99	3.1	10.2
R - Y	5A 2 Ground floor	417	11.60	8.30	0.99	2.1	21.3
Y - B		418	1.09	0.78	0.99	1.6	1.4
B - R		417	13.70	9.78	0.99	2.0	1.9
R - Y	5A 2 Forth floor	410	2.24	1.49	-0.94	2.0	54.8
Y - B		415	0.69	0.47	-0.95	1.5	3.9
B - R		417	14.10	10.07	-0.99	3.1	43.3
R - Y	5A 2 area common light	391	4.74	3.13	0.97	2.2	3.8
Y - B		395	22.30	15.09	0.99	1.9	20.2
B - R							
R - Y	AC UPS/SERVER ROOM	418	27.40	14.10	0.71	2.1	1.3
Y - B		410	13.40	2.85	0.65	1.6	5.0
B - R		415	4.18	2.10	0.70	1.3	4.3

Appendix –IV

LIST OF SUPPLIERS/ MANUFACTURERS

APPENDIX – IV
VENDOR/ MANUFACTURERS LIST

Sr. NO	Product/ Equipment	Contact Details
1	Lighting-T5	L-141 MIDC industrial area Ahmednagar-414111 Tel.0241-2779835/2778978 Email-ceo@eetamax.com Contact person: Mr.Dilip Joshi (CEO) Cell.9850895772
2	Energy conserver system for lighting load	Mag. Flux Power saver GLOABTEL convergence Ltd Contact person Mr.Rashes Joshi (DGM Sales) Cell No: +91 9322338581
3	Aircosaver (Energy saving in air conditioning system)	Ecopower Pvt. Ltd. 105 Neelkanth, 98 Marine Drive, Mumbai 400 002 INDIA. Telephone : +91 (22) 22839645 Fax : +91 (22) 22839646
4	Capacitors	Shreem Capacitors Pvt. Ltd. 7/39, Vikram Vihar, Lajpat Nagar-IV, New Delhi – 11024
5	Capacitors and APFC Panels	Matrix Controls & Engineers Pvt Ltd Rajeev Batra 9811624440, Rajeev@matrixcapacior.com E- 725 DSIDC, Industrial Complex, Narela, GT Road, Delhi – 110040 Ph: 01127786945 / 46 / 47, www.matrixcapacitor.com
6	Capacitors and APFC Panels	Saif Electronics 174, Hira Building, 1st Floor, Carnac Road, Opposite Police Commissioner office , Mumbai – 400002 Ph : 022 – 22064626 , 22086613, www.saifel.com
7	Lighting Systems	Philips India Ltd Regional office-North, 9th floor Ashoka Estate, 24, Barakhamba Road New Delhi – 110 001 Telephone No.: 3353280, 3317442, Fax No.: 3314332
8	Lighting Systems	OSRAM India Ltd. Signature Towers, 11th Floor, Tower B, South City-I, Gurgaon 122001, Haryana Tel: 0124- 6526175, 6526178, 6526185
9	Lighting Systems	1)Wipro Limited Sco 196-197, Sector 34-A, Chandigarh - 160 022

		2) Daril Lighting Pvt. Ltd. Ph: +91-265-2341774 M: 9925018665 Email: ceo@darilighting.com 3) Surya Roshni Ltd. Contact Person: Rohan Dave, Asst. Manager M: 9825513086; Email: suryaroshniahd@gmail.com
10	Lighting Voltage Control Systems	ES Electronics (India) Pvt. Ltd. Plot No.82, KIADB Industrial Area, Bommasandra – Jigani Link Road, Jigani Hobli, Anekal Taluk, Bangalore District – 562 106 Telefax: +91 - 8110 – 414547 / 414548,414549 / 414550 E-mail ID: eleindia@energysaversindia.com Website: www.energysaversindia.com
11	HVAC	Voltas Limited 19 J N Heredia Marg Ballard Estate Mumbai – 400038 Energy Audit Draft Report
12	Pumps	1) Shakti Pumps India Ltd. Tel: +91-7292-410500 Email: sale@shaktipumps.com 2) Lubi Industries LLP Tel: +91 79 30610100 Email: indsales@lubipumps.com 3) Grundfos Tel: +91 79 4003618 salesindia@grundfos.com
13	Variable Speed Drives	ABB India Ltd. Contact: Tukaram Korke, Manager-sales Ph: +91-20-66243828 M: +91-9765551612 tukaram.korke@in.abb.com

Annexure – 14

ગુજરાત પ્રદૂષણ નિયંત્રણ બોર્ડ

પ્રાદેશિક કચેરી : કચ્છ (પૂર્વ)

કંડલા પોર્ટ ટ્રસ્ટનું વહીવટી મકાન રૂમ નં. ૨૧૧, ૨૧૬, ૨જો માળ,
સેક્ટર નં. ૮, ગાંધીધામ-૩૭૦૨૦૧, કચ્છ

તપાસ માટે દાખલ થવાની સૂચના (નોટીસ)

પાણી અધિનિયમ ૧૯૭૪ ની કલમ - ૨૩, હવા અધિનિયમ ૧૯૮૧ ની કલમ - ૨૪ અને પર્યાવરણ (સુરક્ષા) અધિનિયમ - ૧૯૮૬ની કલમ-૧૦ હેઠળ બાયો મેડીકલ વેસ્ટ નિયમ-૨૦૦૮ હેઠળ અમોને મળેલ સત્તાની રૂએ અમો નીચે સહી કરનાર અમોને જરૂરી લાગે તેની સહાય લઈને તમામ સમયે નીચેના હેતુઓ માટે આપની જગ્યામાં દાખલ થવાનો અને તપાસ કરવાનો અધિકાર ધરાવીએ છીએ.

(૧) અમોને સોંપેલા રાજ્ય બોર્ડ/કેન્દ્ર સરકારના કાર્ય બજાવવાના હેતુ માટે

(૨) આવા કોઈ કાર્યો બજાવવાના છે કે કેમ અને તેમ હોય તો કઈ રીતે બજાવવાના છે અથવા આ અધિનિયમ અથવા તે હેઠળ કરેલા નિયમોની અથવા આ અધિનિયમ હેઠળ બજાવેલી કોઈ નોટીસની, કરેલા કોઈ હુકમની, આદેશની અથવા આપેલા કોઈ અધિકાર પત્રની કોઈ જોગવાઈનું પાલન કરવામાં આવી રહ્યું છે કે પાલન કરવામાં આવ્યું છે કે કેમ તે નક્કી કરવાના હેતુ માટે.

(૩) કોઈ સાધન સામગ્રી, ઔદ્યોગિક પ્લાન્ટ રેકર્ડ, રજીસ્ટર, દસ્તાવેજ અથવા અન્ય કોઈ મહત્વની વસ્તુની તપાસ કરવા અને તેની કસોટી કરવાના હેતુ માટે અથવા જે જગ્યામાં તેને એમ માનવાને કારણ હોય કે આ કાયદા કે તે હેઠળ કરેલા નિયમો મુજબ કોઈ ગુનો કરવામાં આવ્યો છે, અથવા થવાની તૈયારીમાં છે, તેવી કોઈ જગ્યાની ઝડતી લેવા માટે અને તેને એમ માનવાને કારણ હોય કે આ કાયદા કે તે હેઠળ કરેલ નિયમો હેઠળ કરેલ શિક્ષાપાત્ર કોઈ ગુનો કર્યાનો પુરાવો, તેવા સાધન સામગ્રી ઔદ્યોગિક પ્લાન્ટ, રેકર્ડ, રજીસ્ટર, દસ્તાવેજ અથવા અન્ય મહત્વની વસ્તુ કબજે લેવા માટે અમે નીચે જણાવેલ સમયે દાખલ થઈએ છીએ.

ઉદ્યોગ/....~~.....~~.....માં દાખલ થવાનો સમય : સવારના / સાંજના..16:40.....તા..28/08/2017

ટુકડી સાથે સહાય માટે નીચેની વ્યક્તિઓ પણ છે.

૧. R. J. Acharya (AEE)

૨. ———

૩. ———

ID-31463

પ્રતિ,

.....Mundra SEZ Ltd.

.....Mundra

.....Kutch

નકલ મળેલ છે.

આ સુચના (નોટીસ) મેળવનારની સહી

સહી : Rthm

અધિકારીનું નામ : R. H. Jivani

હોદ્દો : S.O.

Sumit Pali Wal

Mr. Sumit Pali Wal

Sr. Manager Env.

ગુજરાત પ્રદૂષણ નિયંત્રણ બોર્ડ

પ્રાદેશિક કચેરી : કચ્છ (પૂર્વ)

કંડલા પોર્ટ ટ્રસ્ટનું વહીવટી મકાન રૂમ નં. ૨૧૫, ૨૧૬, ૨જો માળ,
સેક્ટર નં. ૮, ગાંધીધામ-૩૭૦૨૦૧, કચ્છ

ગુજરાત પ્રદૂષણ નિયંત્રણ બોર્ડના અધિકારીઓ દ્વારા આપના એકમની આજરોજ જુદા જુદા પર્યાવરણીય નિયમોને આધિન સ્થળ મુલાકાત લેવામાં આવેલ.

આપના એકમના સ્થળ ઈન્સ્પેકશન દરમ્યાન કરેલ અવલોકનો, આપે આપેલ માહિતી / દસ્તાવેજો અને પર્યાવરણીય નિયમોની જોગવાઈઓને આધીન, આપને નીચે મુજબ આદેશો આપવામાં આવે છે જેની પૂર્તતા અંગેનો અહેવાલ (કોમ્પલાયન્સ રીપોર્ટ) આ આદેશો મળ્યાની તારીખથી બે સપ્તાહની અંદર આ કચેરીને અચુક મોકલી આપશો.તેમ ન થતા આ બાબતે કોઈ રજુઆત નથી તેમ માની, આપના એકમ સામે ધોરણસરની કાનુની કાર્યવાહી કરવાની ફરજ પડશે. જેની નોંધ લેશો.

કાયદાના પાલન અન્વયે સુધારાત્મક પગલાં સંબંધિત નોટીસ :

To, Mundra SEZ Pvt. Ltd.
Mundra, Kutch.

31463
28/8/17.

(1) પ્લાન્ટ / ફેસીલીટી ઉદ્યોગશાયમ ની ગટર લાઈનો ચોકઅપ, ગટર લાઈનો ચોખ્ખી કરાવી લેવડી કરાવવી.

(Mr. Sumit Puliwal)
Sr. manager Env.

(R.J. Acharya)
AEE.

(R.H. Jivani)
S.O.

Annexure – 15

Adani Foundation Mundra










DEDICATED EFFORTS FOR HOLISTIC DEVELOPMENT

Contents

Mission AF : "Save Girl Child" & "Greet Girl Child"








EDUCATION PROJECTS

1. Balvadi at Fisherfolk settlements
2. Other Education Project

Education :

- **Praveshotsav Kit is ready for 106 schools of Mundra Taluka, 6 Schools of Mandvi Taluka and 8 Schools of Anjar Taluka. Total 2200 kit distributed.**
- **Initiated Same concept at Sharda Mandir Govt Primary school Mundra (School is situated between worker/labour Vasahats. Students are not able to cope up with basic subjects (Maths, Science and Gujarati). Our objective is to strengthen their base and increase their minimum level.**
- **Total more than 80 students benefitted, minimum level exams taken. Students are distributed as per their levels after minimum level test. Course material is designed for all level. Not only study we do over all personality development and personnel meeting with each students.**
- **Education : Fisherman**
- **Children are of age 2.5 to 5 years are learning in Balwadi and they also teach each other. Children are learning rhythms, best out of waste, balvarta display on LCD and other activities of education with fun. Total Number of students : 1st year – 64 and 2nd Year – 81 Total : 145 students are studying in Balvadi**
- **Education Material support to 67 Students of Juna Bandar, Zarpara, Navinal, Bhadreshwar & Vandi of Standard 9th and 10th.**
- **Vehicle Support is planned for 106 students of Juna Bandar, Luni Bandar, Bavadi Bandar and Luni Village. Entertainment through Games like Snakes and Leaders.**
- **As Education initiative for children at Balwadi are able to read write and speak A B C , numeric 1-50 very well. Moreover they are also teaching other fellow students.**

Adani Vidya Mandir : Success in Gujrat Board Examination

AVMB Std.-10 First Batch Result 2016/17			
No.	Grade	Students	Pass
1	Upto 70%	2	Pass
2	Upto 60%	5	Pass
3	Upto 50%	11	Pass
4	Upto 45%	3	Pass
Total		23	21
Percentage		90%	

AVMB Std.-10 First Batch Result 2016-17

Adani Vidya Mandir Bhadreshwar achievement in Gujrat Board Standard 10th Examination Result 91% (21 students have passed the examination out of 23). Adani Foundation will take all responsibility of further study of students with respect to their interest.

Community Health : Mundra

Mobilevan OPD April to Sep-2016							
Month	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Total
OPD	2758	2460	2157	1751	2024	1927	13077

Rural Clinic OPD April to Sep-2016							
Month	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Total
OPD	2999	2811	3034	2275	2390	2484	15993

Sr.No	Name CFS	Total HCP	Submit Cards	submit Files
1	All Cargo	10	5	10
2	Sea Bird	20	14	20
3	Maruti Nandan	78	22	66
3	Saurastra CFS	90	90	90
4	other all CFS	227	67	66
Total		**425**	**198**	**252**

Senior Citizen Scheme	
Month	**OPD**
April	710
May	796
June	787
July	804
Aug,	758
Sep.	932
Total	**4787**

Poor Patients Support
698 Patients had been supported for treatment of illness.

- **Mobile Dispensaries & Rural Clinics**

During this six month, total **13077** patients were provided with free Health Care Services by Mobile Dispensaries at 26 villages and 6 Fisherfolk settlements . **15993** patients benefitted by the medical services at Rural Clinics at 11 locations.

- **Health Cards to Senior Citizens**

During the month, total 4787 transactions were done out of 7487 card holders by beneficiaries Sr. Citizens of 65 Villages Mundra Taluka and they received cash less medical services Under this project. We have entered into third phase of the project.

Dialysis Data April -17 To Sept-17								
Sr.No.	Patient Name	17-Apr	17-May	17-Jun	17-Jul	17-Aug	17-Sep	Total
1	Ramjan Adam	8	10	10	7	8	7	**50**
2	Narshi Samecha	5	-	-	0	0	0	**5**
3	Karim Theba	10	10	11	11	8	7	**57**
4	Budhiya Juma	8	7	9	5	0	0	**29**
Total.		**31**	**27**	**30**	**23**	**16**	**14**	**141**

Community Health All Project Data at Adani Hospital - Total OPD & IPD for April to September-2017

Community Health Project OPD & IPD Data April -17 to Sep-17																				
Projects	Apr-17			May-17			June-17			July-17			Aug-17			Sep-17			Total		
	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total	OPD	IPD	Total
Sr.Citizen	710	0	710	796	0	796	787	0	787	804	0	804	758	0	758	932	0	932	**4,787**	**0**	**4,787**
Medical Supports	120	3	123	127	5	132	115	3	118	82	1	83	115	0	115	126	1	127	**685**	**13**	**698**
Physio Camp	0	0	0	0	0	0	23	0	23	23	0	23	7	0	7	14	0	14	**67**	**0**	**67**
Dialysis	31	0	31	25	0	25	30	0	30	23	0	23	16	0	16	14	0	14	**139**	**0**	**139**
CFS Drives HCP	0	0	0	0	0	0	0	0	0	162	0	162	175	0	175	86	0	86	**423**	**0**	**423**
Total	**861**	**3**	**864**	**948**	**5**	**953**	**955**	**3**	**958**	**1094**	**1**	**1095**	**1071**	**0**	**1071**	**1172**	**1**	**1173**	**6101**	**13**	**6114**

Overview: "Suposhan Project"

- **To curb malnutrition amongst Children, Adolescent girls and Women in our CSR villages**
- To reduce malnutrition and anaemia amongst adolescent girls and pregnant & lactating women by 70% in three years
- To create awareness about the issue of malnutrition and anaemia and related factors amongst all stakeholders and role they may play in curbing the issue
- To create a pool of resources to be utilised for combating the issue of Malnutrition and Anaemia
- To support efforts in reducing IMR and MMR

Strategy: "Suposhan Project"

- Community based intervention with Community Health Workers from local communities. (Sangini)
- Each child and especially malnourished will be mapped with growth chart
- Regular inputs of THR, RUTF and other micronutrients treatment when necessary facilitated via Govt. Schemes and if necessary through AF
- FDGs with mothers and adolescent girls
- Village meeting one in a month at every village
- Health camp every month
- Awareness campaigns
- Cross Functional, across locations learnings

Outcome: "Suposhan Project"

- Reduction in occurrence of malnutrition amongst Children by 95 % in three years
- Reduction in malnutrition and anaemia amongst adolescent girls and pregnant & lactating women by 70% in three years
- Create awareness about the issue of malnutrition and anaemia and related factors amongst all stakeholders and role they may play in curbing the issue
- Create a pool of resources to be utilised for combating the issue of Malnutrition and Anaemia
- Support efforts in reducing IMR and MMR

Overview: "Suposhan Project"

Community Engagement and other Activities		Sept-17
Sr.No	Activity	Progress
1	No of Sangini	40
2	Total Village Cover	56
3	Total Anghanvadi Cover	99
4	Total PRA	9
5	SAM to MAM Monitoring Progress	28
6	MAM to Normal Monitoring Progress	13
7	SAM/MAM Child Camp	3
8	Focus Group Discussion	1003
9	Family Based Counselling	174
10	Village level Events	390
11	Formation of women's groups	242
12	Formation of adolescent's Groups	219
13	No of SAM children referred to CMTC	18
14	No of SAM children provided with RUTF	58
15	Total HB screening - RPA	2172
16	Total HB screening - Adolescent girls	3774
17	Women in RPA provided with IFA Tablets	161
18	Adolescent girls provided with IFA Tablets	239
19	Anthromatry Study (0 to 5)	7202
20	Sangini Meeting	17
21	Sangini Training	9

Community Health : Overview


Rural Clinic


Dead Body Van

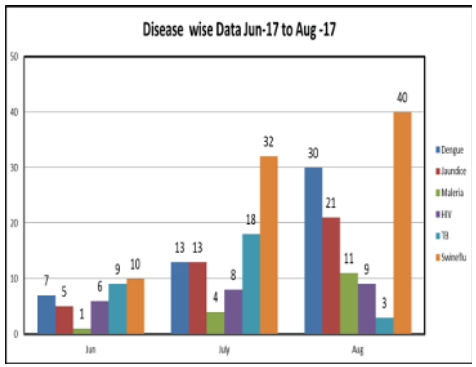

Sangini Training


Mobile Van


Physiotherapy Camp

GAIMS : Health is Wealth ....

- Total 5547 Patients received Special Care and Coordination upto Sep 17 at GKGH regarding Hospital, Lab, OPD Department, Ward and Pharmacy Service.
- During six months Different 125 Village Level Meetings Organised with Sarpanch, Leader, Women Groups and other Stakeholders .
- We have Started School Health Check Up Under the "Safe child Project" in this six months Total 11 Schools Covered and 2263 Students has been benefited in camp.
- In this six months Total 363 dead bodies were shifted to different villages in Kutch District.



Safe Child Project/ School Health Checkup			
No of School	Covered	No.of Student	Covered
	11		2263

Death Body Van and Hospital Death Data			
Sr No.	Month	AF Van	Death in GKGH
1	April	57	65
2	May	63	78
3	Jun	52	58
4	July	49	55
5	Aug	75	92
6	Sep	67	120
	Total	**363**	**468**

Fisherfolk Amenities

Computer training : 30 Fisherman Youth

- Regular Meetings at bander with fishermen, fisheries department and coast guard
- to create awareness about fisheries scheme and cooperate during mock drill and Vessel approach
- Meeting at Kutdi regarding street light drinking water and approach.

Sewing training : 60 Women (Zarpara/Juna Bandar)

- Meeting and site visit with Luni fishermen leader & Kutch Jilla Machhimar Association Pramukh to provide potable water at Bavadi, Randh and Luni fishermen vasahat with collaboration of gram panchayat and GWIL(Gujarat water infra structure limited).
- Survey and meeting with fishermen regarding use of "Ma- Amrutam Yojna" and RSBY card.

- We have applied for Model cage unit in fisheries department for juna bandar(shekhdiya) fishermen in consultation with CMFRI.
- Cage culture project the total production may be 120 kg and we have plan for harvesting In next month. Community operated projects and taken care by community.

Mangroves plantation : 4000 Man-days

- With the help of I Khedut portal We can apply online for different agricultural(fisheries)department scheme.
- We have create awareness of this portal by Luni and Juna Bandar computer training center

Painting Labour : 3800 Man-days

Sustainable Livelihood Programme

Fodder Demonstration

Demonstration for NB 21 extended with 42 farmers for get better results for fodder cultivation. In this project, Parjanya Ecology was our implementing partner and Krishi Vigyan Kendra was our guide for the project. Total 14 acre land has been covered under this demo production in first phase 1.12 Lac Kg.

"Saheli Mahila Gruh Udyog"

Till date "Saheli Mahila Gruh Udyog "has annual turn over of more than Rs. 5.00 Lacs.
After one year of Pilot phase, Saheli Mahila Gruh Udyog includes 70 women. We are planning to convert "Saheli Mahila Gruh Udyog" into Producer company. Planning for 1. Production of Hygiene Products 2. Edible products and 3. Handicraft items capacity building women group

"Beti Vadhavo"

Beti Vadhavo Abhiyan" initiative has been taken by Adani Foundation in order to change the mindset of our society and think positively towards the girl child since four years. We are greeting each girl child born in Mundra Taluka with Kit including (one pair cloth, soap, shampoo, powder, mosquito net, bed sheet and nutritious food for mother). Joint efforts of Taluka Health Office, ICDS and Adani foundation greeted 121 daughters at Tunda, Siracha, Vadala, Goersama, Navinal and Gundala Village.

"Support to Handicapped, widows and senior citizen by Govt Schemes"

- We are playing the role of facilitator in case of tie up with Government Scheme for Widows, Senior Citizens and Handicapped people. The identity cards are issued to two persons for the handicapped in coordination with Bhuj Samaj Suraksha Khata for regular visit and follow up.
- During the period , 8 widows and 204 handicapped - total 212 members got benefitted by different schemes of Government. The financial benefit of the senior citizen Yojana is Rs. 400 per month and the widow scheme is of Rs. 900 per month.

Rural Infrastructure Development : Building Block of the Society

Adani Foundation has designed, planned and built a strong infrastructure for bettering education, community health, agriculture and living standards, all according as per official requests and demands of people of the community and the Gram Panchayat.

Work completed :

- **Mota Bhadiya and Bhujpur- Pond deepening work**
- **Bhadreshwar- Prayer shed in School**
- **Kandagara – Garden work in matang temple**
- **Zarapara – canal repairing work**
- **Shekhadia- Pagadiya fisherman road repair**
- **Shekhadia- construction of Bhunga Pagadiya fisherman**
- **Kutdi bander- construction of cricket pitch**
- **ASDC- civil works completed.**
- **Kandagara - Repairing of Checkdam and river widening**
- **Mundra- crematorium development**
- **Ragha - Prayer shed in primary school**
- **Shekhadiya – Const. of house of fisherman**

Adani Skill Development Center: Mundra

Along with computer related trainings, Stitching and Bagging training, Beauty Parlor and Mobile Repairing Training are also in full fledge at Gundala, Adani Ports, Navinal and Mundra

Soft Skill training					
Sr. No.	**Course Name**	**Location**	**Male**	**Female**	**No.of students**
1	Beautification training.	Mundra	0	20	20
2	Advance Excel training	Adani house	20	0	20
3	IT Basic Computer training	Navinal	13	7	20
4	IT Basic Computer training	ASDC	2	4	6
5	IT Basic computer-CRTG student training	ASDC	7	0	7
6	Wedding Mehnadi training	Gundala	0	16	16
7	Thread work training	Gundala	0	20	20
8	IT Basic computer-CRTG student training	ASDC	7	0	7
9	Spoken English	ASDC	13	3	16
10	IT Basic Computer training	Adani house	20	0	20
11	IT Basic Computer training	ASDC	0	7	7
12	IT Basic computer-CRTG student training	ASDC	7	0	7
13	Thread work training	Luni	0	14	14
14	Computer Excel training	Adani house	19	0	19
15	IT Basic Computer training	ASDC	7	0	7
		Total - A	**115**	**91**	**206**

Adani Skill Development Center: Mundra

Technical Training					
1	Checker cum RTG crane operator training	APSEZ	21	0	21
2	Tailoring training	Borana	0	30	30
3	Tailoring training	ASDC	0	14	14
4	Tailoring training	Mundra	0	41	41
5	Vocational training	Zarpara	38	7	45
		Total - B	**59**	**92**	**151**
Carier Guidance and Knowlage bage training					
1	Personality Devlopment training	ASDC	23	4	27
2	Personality Devlopment training	ASDC	13	3	16
		Total - C	**36**	**7**	**43**
		Grand Total A + B+C =	**210**	**190**	**400**

Important Events

Adani Cricket tournament final match between Navinal and Kathada team was organized at Shantivan cricket ground . The Final match was very thrilling and after all king of Navinal team won. we invited fishermen leader from different villages and officers from Gujrat Fisheries board, Forest and Sport department. on this occasion Mr. Mukesh Saxena (COO,APSEZ) were present to motivate players and promised to support them for coaching for their better future in cricket. The trophy and prize of- 25000 INR and 15000 INR awarded to winner and runners up team. Total 58 team & 609 Youth participated in tournament and We distributed cricket kit to all participated teams. **The best player is selected for training at Rajkot (Yusuf Bamaniya Academy) for his bright future.**

Shikshan Manthan Shibir

Background : Kutchh District is very poor in case of Education. Educational Standards of Govt. School is considerably depraved. It leads to pathetic situation for students. It continuously destroys our young generation in absence of proper direction and base. That's why we have planned for workshop for school teachers on innovative teaching.

Objective : It will be one of the many initiatives taken by AF to changing the teaching patterns being practised and how to simplify it.

Outcome : This would be extremely beneficial for the teachers and would help them get equipped with new teaching techniques and broaden up their notions in the domain of education

Impact : This kind of workshops can have a long term impact on the development of teachers and enhance their soft skills. First Workshop arranged on 1st Aug 2017 Guest : Mr. Jargela – DPEO

Beneficiaries : Principles of all 106 primary schools of Mundra

Trainers : Mr. Daxa Rajgor and Mr. Sanjay Thaker (District Institute of Education Training)

Seminar on " Qualities of an effective teacher: This module has given answers to some focussed questions on Qualities of an effective teacher like How, why and what works best in a classroom? Child psychology, Where to start to improve in teaching learning styles? What makes an effective teacher?

Important Events

Adani Foundation believes that, "The children of today will shape the future of tomorrow" and "We should always give a chance and support to educate girl child". To make bright future of children of fisherman Adani foundation has provided fee support to 174 Students at SMJ High School Luni.

Adani Foundation plays role of facilitator between government and community for Government Schemes for divyang, widows and senior citizens. Till date we were supporting divyang by schemes of state government. Tri-cycles were distributed among 142 differently able persons of Mundra and surrounding areas, at a function held at Mundra Taluka Health Office on Wednesday. AF, Mundra coordinated the entire process of issuance of tri-cycles to the beneficiaries with concerned authorities in Govt. of India and facilitated the distribution jointly with local Health dept. authorities.

Public hearing Copper Plant Adani Foundation Mundra has organized "Sneh Milan" Programme on 27th April 2017 Thursday. Total 155 local people participated including Sarpanch, village leaders and NGO working for welfare of community and media as well. Main Objective of Sneh Milan Programme was to brief about upcoming "Adani Copper Project". Mr. Surya Rao (VP, Adani Copper) had presented information about copper plant. Mr. Mukesh Saxena had warmly welcomed community leaders and obliged for their strong support in journey of development.

Stake holder Engagement

Women Participation in income generation activities through self help groups has created a positive impact on the life pattern of women and that has empowered them at various levels not only as individuals but also as members of the community and the society as whole. Adani Foundation has developed 7 SHG Groups consists of 97 members (Saving 2.5 Lacs for 18 months). Apart from savings, this women are associated with Saheli Mahila Gruh Udyog – preparing household items i.e. washing powder, phynayle, dish wash liquid etc. The groups are empowered to market their products themselves. The profits drawn from their rural enterprises are now being used for their essential family requirements and education of their children.

Regular meetings with Fisherman Community at Vasahats are conducted regularly. Main topics are covered about safety in sea, importance of savings, health and hygiene, various schemes of fisheries department, women empowerment, training and development of Adani skill development center etc.
This type of interaction create trust and transparency towards community. Direct contact will increase rapport also. AF Team is also part of community function as well as personnel functions of the community. The youth engagement initiatives i.e. fisherman cricket match, cycle marathon etc. are also necessary.

Biogas is a clean, non-polluting and low cost fuel. It contains about 55 to 75 percent methane, which is inflammable. Bio gas can be produced from cattle dung, human waste and other organic matter by a process called "Anaerobic digestion" which takes place in a biogas plant. The digested effluent, which comes out of the plant, is enriched manure.
The Multiple benefits of the biogas have changed many lives in rural areas. During the last year 11 plants have been constructed and process for 10 more plants is going on. We are providing support addition to Government support to the beneficiary. (Under bio-gas scheme of government, the total cost is Rs.33, 500 out of which Rs.15, 000 will be granted by the government and out of the pending amount of Rs.18, 500 sum of Rs.10, 000 will be contributed by the Adani Foundation. The beneficiary will have to pay only Rs. 8, 500). Beneficiary women use the time, saved from cooking and fuelwood collection, to take up an additional economic activities.

During the non-fishing months, the fishermen under usual circumstances were benefit of any other alternate economic activity to sustain them. Under such cases due to the scarcity of their available funds and resources, it became extremely difficult for a majority of them to survive. Looking at the miseries the Foundation introduced 'mangrove plantation' and "Mangroves Algae Removal" in the area as a means of alternate income generating activity for the fisher folk community during the non-fishing months. Both men and women from the communities received trainings on Cheriya Plantation, moss cleaning etc. required for mangrove plantation. The program again was developed holistically, where focus was not only given on income generation but this initiative was seen as an important means to ensure environment sustainability. At the moment total 110 fisher folks from Luni, Shekhadia and Bhadreshwar are working for mangroves plantation and cleaning and getting income upto Rs. 300 per day.

Kitchen Garden
We have motivated adolescent girls and their mothers to develop kitchen garden at the back of their house. We have selected three different beneficiaries having biogas at their vadi. Kitchen garden and bio gas plant combination brings worth results for "Suposhan" in Adolescent girls.
All the vegetables grown at the garden are consumed by their own house. This is a model developed to motivate local people to develop a small kitchen garden in their home to get access to nutritional vegetables.

Bhujpur, a village 20 kilometres from Mundra has agriculture as its main occupation. The people of Kutch have to face the water related problems due to the geographical location of Kutch and the salinity of sea water here. Bhujpur has two inter connected ponds. Once the Sarpanch of the village Meghraj Gadhvi thought of deepening the pond and this he put forward in form of a request to the Head of the Adani foundation in coordination with the village heads, school teachers and the various members of women organizations. This participatory approach brought matter of great amazement when the village offered their services of three tractors. The villagers were happy to acknowledge that if the ponds keep on getting filled up year after year, it would help in increasing the level of ground water. It would also decrease the salinity of water and increase the agricultural production.

"Spreading Smiles"

A Large portion of the rain fed areas in Kutchh are characterized by low productivity, high risk and uncertainty. This leads to degradation of natural resources. Part of watershed management programmes, Check dam strengthening by de silting and repairing at Kandagara village is initiated. Work is completed before monsoon and village community is with Adani Foundation team since beginning of the project. Main objective is to control damaging runoff and degradation and thereby conservation of soil and water

Kamila ben Sheda owns 11 milch cows and two bulls. She was spending almost 40% money she earned from selling milk – on feeding his cattle. This squeezed his profits. Adani Foundation in coordination with Krishi Vigyan Kendra/Parjanya Ecology started demonstration of NB-21 (Type of Fodder which grows fast with less water)
Impact : She adopted this technique and also ensures that cattle will get proper balance food. This has reduce her cost of cattle feed considerably. She demonstrated the technique in 0.75 Acres of land and production in first cutting is total 8000 kg. She is our proud as she is the first lady farmer who adopted NB-21 technique and got good results.

"Disaster Management"
Building Relations Over Troubled Water : Banaskantha District

Due to the recent heavy rains, many villages in the Banaskatha region of Gujarat have become flooded.

Many villages in Banaskantha district continue to remain cut off because the bridges and roads in route have been washed away. Number of villages affected by flood and faced large damage of lives, animals and goods.

Adani Foundation Mundra decided to start relief work after taking a preliminary survey of the flood affected areas. Mr. Karsan Gadhavi and Mr. Ishvar Parmar started their journey towards Banaskantha on 28th July 2017. They visited Dhanera, Tharad and Vav District . First they meet SDM and Mamlatdar of Tharad and Dhanera. With help of Govt dignitaries they received list of most affected villages of Tharad district. As a second step, they visited all suggested villages and did survey about issues i.e. ration, drinking water, approaches, cattle fatality, damages in schools and other govt. properties. Ishvar bhai and Karsanbhai was stationed there for four days.

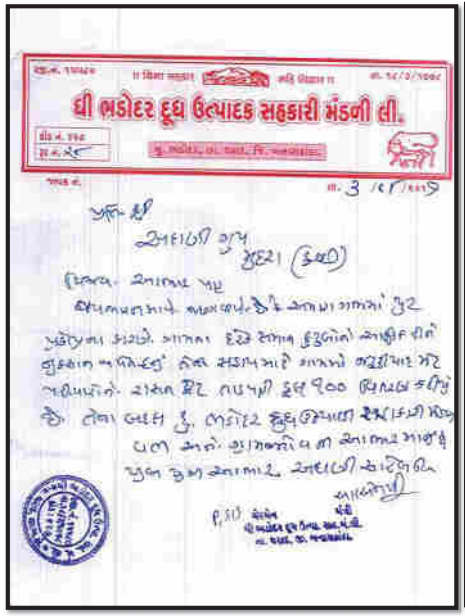
Based on requirements of district administration and feedback of our team members, AF Mundra team had decided to march on 3rd Aug 2017 early morning with big flood rescue team.

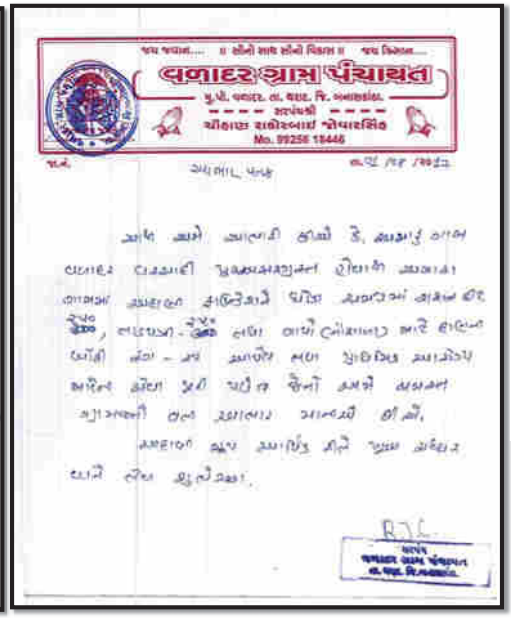
Journey towards dignity

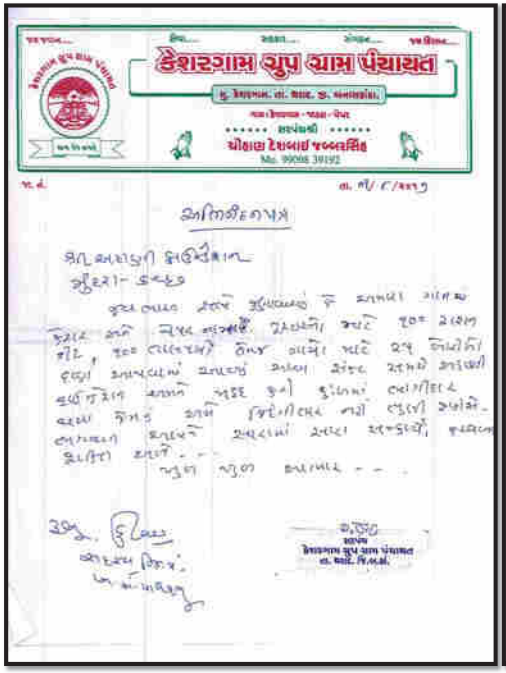
It is our moral responsibility as a Foundation to take the responsibility of flood relief work in Tharad taluka which is badly affected by flood. With based on suggestions of district administration, AF Mundra has started march with 12 members team and AF Ahmedabad has started with 8 members team on 30th July 2017.
The flag off done by SDM Mundra and Mamlatdar Mundra. Entire teams are fully charged up to severe affected villages as per need given by Govt and based on survey of our team members who went earlier to get details.

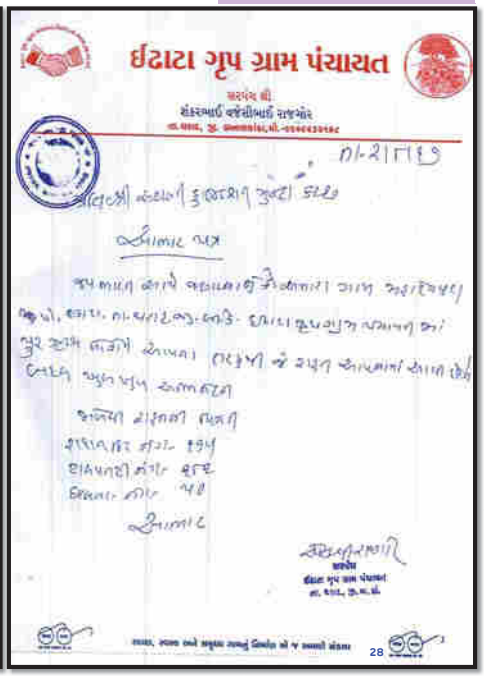
"Disaster Management"
Building Relations Over Troubled Water : Banaskantha District

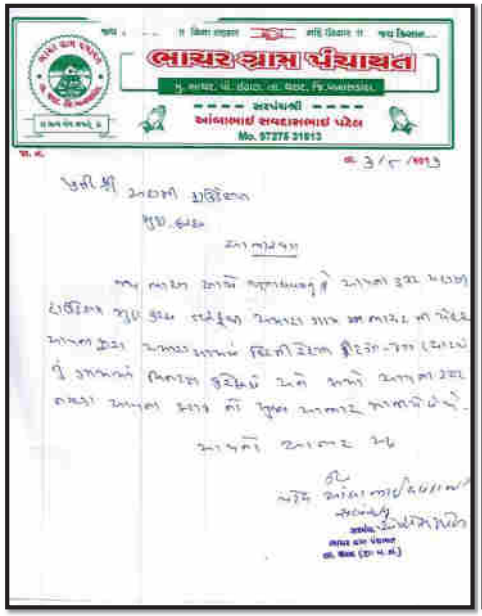
Flood Relief Work at Tharad Taluka (Banaskantha - Gujarat)							
Sr. No	Village	Details of Supported Items					
		Food Packet (Rasan Kit)	Tarpaulin with rope	Fodder	Blanket	Water (Pouch)	Requirement (2nd Layer Flood Relief)
1	Nani Pavad	150	60	25	60	1000	Fodder for cattle and Health Service
2	Datiya	285	100	30	100	1000	R.O. Plant as drinking water is too bad quality, Education Kit
3	Vadadar	250	250	25	500	1000	Bore well for clean drinking water
4	Pepar	50	50	19	100	500	Fodder, Education Kit and Health services
5	Kesargam	50	50	6	100	500	Fodder and Health services
6	Vantadau	350	300	55	0	1500	R.O. Plant and Health services
7	Mahadevpura	175	180	0	100	1000	R.O. Plant and Education Kit Health services
8	Khanpur	50	0	0	0	500	Still some part of village is submerged Cleaning required, Road repairing work and fodder, Education Kit
9	Bhachar	400	0	0	0	2000	Health camps
10	Bhadodar	100	100	0	0	1000	Health services
11	Benap	80	80	0	0		
12	Other	60	30	0	40		
	Total	**2000**	**1200**	**160**	**1000**	**10000**	

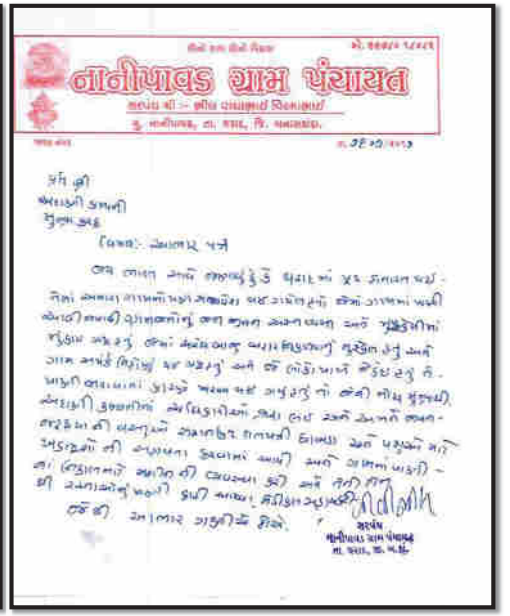












અદાણી ફાઉન્ડેશનનો આર્થિક સહયોગ

ભુજમાં 110 વર્ષના વૃદ્ધાના થાપાનો ગોળો બદલાવાયો

જી.કે. જનરલ હોસ્પિટલમાં કરાયું સફળ ઓપરેશન

ભાસ્કર ન્યૂઝ.ભુજ

સામાન્ય રીતે વરિષ્ઠોની શસ્ત્રક્રિયા તબીબો માટે પડકારરૂપ બની રહે છે, તેવામાં ભુજની જનરલ હોસ્પિટલમાં 110 વર્ષના વૃદ્ધાના થાપામાં ગોળો બેસાડવાનું ઓપરેશન સફળતાપૂર્વક પાર પાડવામાં આવ્યું હતું. અદાણી ફાઉન્ડેશનના આર્થિક સહયોગથી કરાયેલી આ શસ્ત્રક્રિયામાં વયોવૃદ્ધ દર્દીને લોહી ચડાવવાની કે આઈસીયુમાં રાખવાની જરૂર પણ પડી ન હતી.

ભુજ ગાગોદરના હાલે હમીપર કુભારાભ આક્રમણમાં રહેતાં લાક્ષીબેન મહાદેવ પ્રજાપતિ બેએક મહિના પહેલાં લપસી પડતાં તેમના થાપામાં ગોળીએ ફ્રેક્ચર થયું હતું. તેમના પુત્ર કરસનભાઈએ સ્થાનિકે કરાવેલી સારવાર કારગત ન નીવડતાં તેમજ કેટલાક નિષ્ણાત તબીબોએ ઉંમરની દૃષ્ટિએ જોખમી જણાતા ઓપરેશનનો ઈન્કાર કરી દેતાં ભુજની અદાણી સંચાલિત જનરલ હોસ્પિટલમાં લાવ્યા હતા.

હાડકા વિભાગના ડો. પારસ મોટવાણી, ડો. સંગીન ભુરિયા, ડો. ગૌરવ કાલરિયા, ડો. નવીન ગાગલ, ડો. સત્યજીત ભારદ, ડો. આનંદ ચિરાણીની ટીમે ઉંમરના હિસાબે જોખમી કહી શકાય તેવું થાપાનો ગોળો બદલવાનું ઓપરેશન સફળતા સાથે કર્યું હતું. તબીબોના જણાવ્યા મુજબ દર્દીને ત્રીજા દિવસથી પથારીમાં હલન-ચલન શરૂ કર્યું હતું. અદાણી ફાઉન્ડેશનના આર્થિક સહયોગ માટે કિશોર ચાવડાએ ચાવીરૂપ ભૂમિકા

જી.કે.માં ૧૫૦ પથારીવાળો કોર્પોરેટ વોર્ડ

૮૦૦ ગ્રામ વજનવાળા નવજાત

શિશુને મોતના મુખેથી બચાવાયો

મહિલાઓ સ્તન કેન્સર બાબતે જાગૃત બને

વાહન ચલાવતી વેળાએ જાગૃતિ અને તકેદારી રાખવાથી માર્ગ અકસ્માત થતા નિવારી શકાય

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નિઃશુલ્ક હેલ્થ કેમ્પ : અદાણી ફાઉન્ડેશન ભુજ તથા સ્વામી વિવેકાનંદ યુવક મંડળ ધાનણધાર સહયોગથી તાજેતરમાં તાલુકાના (ધાનણધાર) વર્ધમાનનગર ખાતે નિઃશુલ્ક જનરલ મેડિકલ હેલ્થ કેમ્પનું આયોજન કરવામાં આવ્યું હતું. આ કેમ્પમાં ૨૫૦ લાભાર્થીઓએ આ આરોગ્યસેવાનો લાભ લીધો.

માંડવીમાં પોલીસનો 'ચાલકમિત્ર' યોજના દ્વારા મેડિકલ તપાસ યોજાઇ

૮૦૦ ગ્રામ વજન ધરાવતા નવજાત શિશુને અદાણી જી.કે.જનરલ હોસ્પિટલ માં મોતના મુખેથી બચાવાયું.

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અદાણી ફાઉન્ડેશન દ્વારા માછીમાર સમુદાયના યુવા માટે અદાણી પ્રિમિયર લીગ ક્રિકેટ ટુર્નામેન્ટનું આયોજ

માછીમાર સમુદાયની અદાણી પ્રીમિયર લીગમાં કિંગ ઓફ નવીનાળ ટીમ વિજેતા

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ભીંજાયલા હૈયાની નહી, ભંગાયલા દિલની આ વાત
કયારેય નહીં ને આજે મજબુરીએ લંબાયલા હાથની આ વાત
કુદરતે આપેલ કે લઇ લીધેલ ! કેવા પ્રકોપની આ વાત
રહેમ કે જીંદાદીલી જે કહો તે બનાસની આપ વીતી કહી આ વાત

Adani Foundation -Mundra
Executive Summary of Budget Utilization - April to September 2017
F.Y. 2017-'18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y.2017-18	Budget Plan upto Sept-2017	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
	Admin Expense	152.05	76.03	56.65	74.51%	37.26%	
A.	Education	59.70	29.85	16.33	54.70%	27.35%	
B.	Community Health	214.49	107.25	68.89	64.23%	32.12%	
C.	Sustainable Livelihood Development	215.00	107.50	149.91	139.45%	69.72%	
D.	Rural Infrastructure Development	374.70	187.35	63.82	34.07%	17.03%	
TOTAL AF CSR Budget :		**1015.94**	**507.97**	**355.59**	**70.00%**	**35.00%**	
+	Adani Vidya Mandir-Bhadreshwar	142.08	71.04	48.82	68.73%	34.36%	
TOTAL - AF & AVMB Approved Budget :		**1158.02**	**579.01**	**404.42**	**69.85%**	**34.92%**	
+	Additional Approved Works	29.20	14.60	22.38	153.29%	76.64%	
GRAND TOTAL		**1187.22**	**593.61**	**426.80**	**71.90%**	**35.95%**	

Adani Foundation -Mundra
HR & Admin Budget Utilization - April to September 2017
F.Y 2017-18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.-2017	Expenditure up to Sept..17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
A	**Salary**						
1	*Present Staff Salary*	91.50	45.75	47.33	103.46%	51.73%	
2	*New Staff Salary*	9.00	4.50	0.00	0.00%	0.00%	
3	HR Expenses	2.00	1.00	0.00	0.00%	0.00%	
	Total HR Expenses	**102.50**	**51.25**	**47.33**	**92.35%**	**46.18%**	
B	**Office Admin expenses**						
1	Office Printing and stationery	0.40	0.20	0.00	0.00%	0.00%	
2	*Travel and conveyance - Staff*	5.00	2.50	1.65	66.19%	33.10%	
3	Legal and professional fees (Lump sum)	0.05	0.03	0.00	0.00%	0.00%	
4	Office equipments and Maintenance	0.20	0.10	0.00	0.00%	0.00%	
5	*Mobile/Internet & Electricity Bill*	2.32	1.16	0.75	64.59%	32.29%	
6	Refreshment/ Guest Entertainment exp.	0.50	0.25	0.00	0.00%	0.00%	
7	Staff meetings / Trainings	0.20	0.10	0.00	0.00%	0.00%	
8	Field office / Training center rent & Field office other Expenses	1.44	0.72	0.09	13.10%	6.55%	
9	*Staff welfare activities*	4.75	2.38	0.00	0.00%	0.00%	
10	Insurance - vehicles	0.25	0.13	0.00	0.00%	0.00%	
11	Four wheel vehicle rent	12.00	6.00	3.09	51.58%	25.79%	
12	*Vehicle maintenance and fuel*	1.30	0.65	0.26	40.58%	20.29%	
13	Staff Capacity building, Training, Appreciation & Exposure visits	2.00	1.00	1.20	120.01%	60.01%	
14	Misc. Office & Admin Expense	0.24	0.12	0.00	0.00%	0.00%	
	Sub Total	***30.65***	***15.33***	***7.06***	**46.05%**	**23.02%**	
C	**Other exp.**						
1	Add. Misc. & Documentation Expenses	3.50	1.75	0.50	28.71%	14.36%	
3	***Staff SV Teachers Colony Exp***	**15.40**	**7.70**	**1.76**	22.83%	11.41%	
3.1	*Colony Maintanance Exp.*	15.00	7.50	4.54	60.50%	30.25%	
3.2	*Parking Shed in Shantivan Teacher Colony*	10.00	5.00	0.00	0.00%	0.00%	
Less:	*House Rent Recovery*	9.60	4.80	2.78	57.92%	28.96%	
	Sub Total	**18.90**	**9.45**	**2.26**	**23.92%**	**11.96%**	
	GRAND TOTAL (BUDGETED) :	**152.05**	**76.03**	**56.65**	**74.51%**	**37.26%**	

Adani Foundation -Mundra
Education Budget Utilization - April to September 2017
F.Y. 2017-'18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.2017	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
1	**Support to Government / Private Educational Institutes**						
1.1	Educational Support at various Govt. schools	8.00	4.00	3.55	88.79%	44.40%	
1.2	Support to ITI	2.00	1.00	0.00	0.00%	0.00%	
	Sub Total	**10.00**	**5.00**	**3.55**	**71.03%**	**35.52%**	
2	**Adani Shaikshanik Vikas Kendra (Strenghening Primary Education)**	**5.90**	**2.95**	**1.87**	**63.55%**	**31.78%**	
2.1	Coaching & project staff Exp.	4.60	2.30	1.75	76.09%	38.04%	
2.2	Housekeeping Exp.	0.60	0.30	0.00	0.00%	0.00%	
2.3	Teaching & Learning Material Exp.	0.50	0.25	0.07	27.20%	13.60%	
2.4	Other Administrative Exp.	0.20	0.10	0.06	56.77%	28.39%	
3	**Training and Development (Strenghening Teachers of High School)**	**0.95**	**0.48**	**0.17**	**36.33%**	**18.17%**	
3.1	Seminar on " Qualities of an effective teacher" (Quarterly)	0.50	0.25	0.17	69.04%	34.52%	
3.2	Workshop 1 : "Continuous and comprehensive evaluation"	0.15	0.08	0.00	0.00%	0.00%	
3.3	Workshop 2 : "Effective Lesson Planning"	0.15	0.08	0.00	0.00%	0.00%	
3.4	Workshop 3: " Effective Administrative Skills" for Principles	0.15	0.08	0.00	0.00%	0.00%	
4	**Educational Support to Migrated Labour Children**	**10.00**	**5.00**	**0.00**	**0.00%**	**0.00%**	
5	**Support for Higher secondary students of AVMB**	**3.75**	**1.88**	**1.03**	**54.79%**	**27.40%**	
6	**Education Project Staff Salary & TA (1 CM)**	**3.10**	**1.55**	**1.25**	**80.48%**	**40.24%**	
7	**Education for Fisher folk**						
9.1	Education Initiative for children at vasahat	22.00	11.00	7.56	68.73%	34.36%	
9.2	Exposure tour, Fee & Other Edu. Support to poor students and cycle support to Fishermen Students	4.00	2.00	0.89	44.67%	22.34%	
	SUB TOTAL :	**26.00**	**13.00**	**8.45**	**65.03%**	**32.51%**	
	GRAND TOTAL (BUDGETED) :	**59.70**	**29.85**	**16.33**	**54.70%**	**27.35%**	

Adani Foundation -Mundra
Community Health Budget Utilization - April to September 2017
F.Y. 2017-'18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.2017	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
B1. Community health programme - on going							
1	Medical mobile units	8.15	4.08	1.58	38.68%	19.34%	
2	Medicines for rural clinics - 12	8.75	4.38	1.65	37.82%	18.91%	
3	Medical support to very needy and poor patients	25.00	12.50	8.49	67.91%	33.95%	
	Sub Total	**41.90**	**20.95**	**11.72**	**55.94%**	**27.97%**	
B2. "Dialysis Support"							
1	Financial support for dialysis	10.00	5.00	2.27	45.37%	22.69%	
	Sub Total	**10.00**	**5.00**	**2.27**	**45.37%**	**22.69%**	
B3 Health card to Senior citizens *							
1	Health card services	90.00	45.00	28.20	62.68%	31.34%	
	Sub Total	**90.00**	**45.00**	**28.20**	**62.68%**	**31.34%**	
B4.Addressing Disability		**3.00**	1.50	0.49	32.75%	16.38%	
B5.Health Camps and Awareness programes							
1	General Health Camp for truckers	12.00	6.00	3.26	54.27%	27.13%	
	Sub Total	**12.00**	**6.00**	**3.26**	**54.27%**	**27.13%**	
Project Staff for Mundra Health Initiative		**8.59**	4.30	2.63	61.17%	30.59%	
	Grand total for Mundra Health Initiative :	**165.49**	**82.75**	**48.57**	**58.70%**	**29.35%**	
B6. Community Health Initiative from GKGH/GAIMS							
1	Medical Support to Poor Patients -GKGH	20.00	10.00	8.25	82.48%	41.24%	
2	Dignity to death - Dead body carrier vehicle support	7.00	3.50	4.22	120.63%	60.32%	
3	**Health Camps and Awareness programes**	**2.50**	**1.25**	**0.67**	**53.66%**	**26.83%**	
3.1	General Health Camp	1.00	0.50	0.27	54.75%	27.38%	
3.2	Safe Child Health Project - NEW	0.50	0.25	0.05	21.38%	10.69%	
3.3	Health Check Up Camping New	0.50	0.25	0.34	137.44%	68.72%	
3.4	GMDC Mining Labor Welfare Programme New	0.50	0.25	0.00	0.00%	0.00%	
4	Collaborative Actions in Lowering Maternity Encounters Death(CALMED)	1.50	0.75	0.01	1.35%	0.67%	
5	Medical Mobile Unit	2.00	1.00	0.61	61.12%	30.56%	
6	Project Staff & Administrative Exp.-GKGH	10.00	5.00	4.21	84.17%	42.09%	
7	Vehicle Hiring Charges	6.00	3.00	2.35	78.29%	39.15%	
	Sub Total - GKGH :	**49.00**	**24.50**	**20.32**	**82.94%**	**41.47%**	
	GRAND TOTAL :	**214.49**	**107.25**	**68.89**	**64.23%**	**32.12%**	

Adani Foundation -Mundra
Sustainable Livelihood Development Budget Utilization - April to September 2017
F.Y. 2017-'18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y.2017-18	Budget Plan upto Sept.17	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
Fisher Folk							
A	**Sustainable livelihood for Fisher folk**						
1	Community Engagement Activities	8.00	4.00	5.41	135.21%	67.61%	
2	Livelihood promotion - Income Generation to individual	5.00	2.50	1.57	62.85%	31.43%	
3	Awareness generation and capacity building	2.00	1.00	0.62	62.48%	31.24%	
4	Potable Water to Fisher Folk at vasahat	18.00	9.00	7.85	87.24%	43.62%	
5	Mangroves plantation and maintenance & Vasahat Cleaning	11.00	5.50	9.66	175.62%	87.81%	
6	Cage farming Asian Sea bass & Lobster	1.00	0.50	0.00	0.00%	0.00%	
	Fisher Folk Budget : Total	**45.00**	**22.50**	**25.12**	**111.62%**	**55.81%**	
Sustainable Livelihood							
B	**Women Empowerment**						
1	Women Empowerment	20.00	10.00	1.17	11.67%	5.83%	
	Sub Total	**20.00**	**10.00**	**1.17**	**11.67%**	**5.83%**	
C	**Agriculture**						
1	Fodder Support -	140.00	70.00	121.19	173.13%	86.57%	
2	Agriculture Initiatives and Support	10.00	5.00	2.43	48.66%	24.33%	
	Sub Total	**150.00**	**75.00**	**123.63**	**164.83%**	**82.42%**	
	TOTAL (APPROVED BUDGETED) :	**215.00**	**107.50**	**149.91**	**139.45%**	**69.72%**	
	Additional Approved Works :						
1	Cage farming Asian Sea bass & Lobster	3.00	1.50	0.00	0.00%	0.00%	
2	Polyculture	1.60	0.80	0.00	0.00%	0.00%	
3	Technical Expert for New Projects	3.60	1.80	1.51	83.92%	41.96%	
4	Flood Relief Work	21.00	10.50	20.87	198.76%	99.38%	
	Total	**29.20**	**14.60**	**22.38**	**153.29%**	**76.64%**	
	GRAND TOTAL	**244.20**	**122.10**	**172.29**	**141.10%**	**70.55%**	

Adani Vidya Mandir-Bhadreshwar
Budget Utilization - April to September 2017
F.Y. 2017-18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.2017	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
A	**Salary Expenses**						
1	Staff Salary	51.15	25.58	19.16	74.94%	37.47%	
2	New Teachers Salary						
3	Non Teaching Staff Exp.	11.20	5.60	4.19	74.78%	37.39%	
	Sub Total	**62.35**	**31.18**	**23.35**	**74.91%**	**37.45%**	
B	**Student Expenses**						
1	Student Uniform Expense	4.42	2.21	3.20	144.62%	72.31%	
2	Food Expenses	50.30	25.15	16.04	63.78%	31.89%	
3	Text books, Notebooks and Work books Expenses	3.03	1.52	2.33	154.12%	77.06%	
4	Co-Curricular Activities	0.25	0.13	0.00	0.00%	0.00%	
5	Extra Curricular Activities Expenses	1.00	0.50	0.09	18.88%	9.44%	
6	Seminar/Conference/workshop/ Teachers Training	0.20	0.10	0.00	0.00%	0.00%	
7	Exposure Tour for Students & Staff	1.00	0.50	0.03	5.88%	2.94%	
8	Exam Fee for Board Examination	0.25	0.13	0.00	0.00%	0.00%	
9	Education Medical Expense, Student & Staff	0.20	0.10	0.00	4.60%	2.30%	
	Sub Total	**60.65**	**30.33**	**21.70**	**71.56%**	**35.78%**	
C	**Other Expenses**						
1	Mobile & Telephone bills/ Fax Expenses/Internet Charges	0.20	0.10	0.07	65.29%	32.65%	
2	Electricity Charges	2.40	1.20	1.03	85.77%	42.89%	
3	Postage & Courier Expenses	0.03	0.02	0.00	1.00%	0.50%	
4	Uniform for Peons-2, Security-2, Aaya-2,Sweeper-2	0.10	0.05	0.00	0.00%	0.00%	
5	Staff Welfare Expenses	0.15	0.08	0.00	0.00%	0.00%	
6	Misc. Expenses	1.00	0.50	0.04	8.35%	4.18%	
7	Travelling/Conveyance Expenses	0.20	0.10	0.05	47.87%	23.94%	
8	Printing & Stationary Expenses	1.50	0.75	0.51	67.49%	33.74%	
9	Newspapers & Periodical Expenses	0.10	0.05	0.01	12.80%	6.40%	
11	Vehicle Hire Charges	0.20	0.10	0.11	112.50%	56.25%	
12	House keeping	0.55	0.28	0.21	78.00%	39.00%	

Adani Foundation -Mundra
Rural Infrastructure Development Budget Utilization - April to September 2017
F.Y. 2017-'18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.17	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
[1]	**Water Conservation and Ground Water Recharge**						
1.1	Pond deepening work	20.00	10.00	16.69	166.88%	83.44%	
	Sub Total	**20.00**	**10.00**	**16.69**	**166.88%**	**83.44%**	
[3]	**Education Related**						
3.1	Prayer shed in vaghervas school,bhadreshwar	5.00	2.50	0.97	38.82%	19.41%	
	Sub Total	**5.00**	**2.50**	**0.97**	**38.82%**	**19.41%**	
[4]	**Health Related**						
4.1	Sanitation block for girls in school, Sadau	3.00	1.50	1.66	110.44%	55.22%	
	Sub Total	**3.00**	**1.50**	**1.66**	**110.44%**	**55.22%**	
[5]	**Other Projects - Corporate Related**						
5.1	Drainage maintenance and JCB hiring	15.00	7.50	6.70	89.36%	44.68%	
5.2	Tuna Port Related CSR Projects	15.00	7.50	0.00	0.00%	0.00%	
5.3	Crematorium development, mundra	5.00	2.50	4.49	179.77%	89.88%	
5.4	Boundry wall and repair of iddgah, tragadi	6.50	3.25	0.00	0.00%	0.00%	
5.5	Garden work in matang temple, kandagara	4.00	2.00	3.09	154.69%	77.35%	
5.6	Basic infra. Facility in Labour Colony	20.00	10.00	0.00	0.00%	0.00%	
5.7	Infrastructure Development for HMV Drivers at North Gate	50.00	25.00	0.00	0.00%	0.00%	
5.8	Study for Mundra Town plan	5.00	2.50	0.00	0.00%	0.00%	
5.9	Development work in Zarpara & Mundra	30.00	15.00	2.84	18.91%	9.45%	
5.10	**Augmentation Of Check Dams budget** Construciton of Toilets in Bhuj taluka 2016-17 Repairing of Checkdam and river widening, kandagara 2017-18	6.00	3.00	4.38	145.88%	72.94%	
5.11	Prayer shed in school, Ragha-Luni	5.00	2.50	0.00	0.00%	0.00%	
5.12	Fisherman Shelter-house Repering-Shekhadiya	50.40	25.20	10.63	42.20%	21.10%	
	Sub Total	**211.90**	**105.95**	**32.14**	**30.33%**	**15.17%**	
[6]	**Fisherman Amenities :** **Infrastructure Support at different Bandar**	**54.80**	**27.40**	**12.37**	**45.15%**	**22.57%**	
[7]	**Startvision Projects**						
7.1	Participatory Ground Water Management	45.00	22.50	0.00	0.00%	0.00%	
	Sub Total	**45.00**	**22.50**	**0.00**	**0.00%**	**0.00%**	
[8]	**Spill Over Projects**						
8.1	Cricket Ground - Siracha	5.00	2.50	0.00	0.00%	0.00%	
	Sub Total	**5.00**	**2.50**	**0.00**	**0.00%**	**0.00%**	
[9]	**Retention Money**	30.00	15.00	0.00	0.00%	0.00%	
	GRAND TOTAL (BUDGETED) (A):	**374.70**	**187.35**	**63.82**	**34.07%**	**17.03%**	

Adani Vidya Mandir-Bhadreshwar
Budget Utilization - April to September 2017
F.Y. 2017-18

(Rs. In Lacs)

Sr. No.	Budget Line Item	Budget F.Y. 2017-18	Budget Plan upto Sept.2017	Expenditure up to Sept.17	% of total Utilization against Planned budget	% of utilization from FY 2017-18 budget	Remarks
13	Bike Expenses (Petrol & Maintenance)	0.20	0.10	0.10	96.39%	48.20%	
14	Vehicle Maintenance & Fuel Expenses (Transportation facilty for Science faculty)	2.85	1.43	0.15	10.72%	5.36%	
15	Water Tank Charges	0.50	0.25	0.48	192.37%	96.19%	
16	Computer Maintenance Charges (Old Computer) & UPS	0.50	0.25	0.01	4.00%	2.00%	
	Sub total	**10.48**	**5.24**	**2.76**	**52.75%**	**26.37%**	
D	**Building & Equipment related Expenses**						
1	Property Tax & Revenue Tax	0.50	0.25	0.00	0.00%	0.00%	
2	Insurance Premium						
3	School Building & Equipment Maintenance Expense + School classroom painting-2017-18	4.70	2.35	0.88	37.43%	18.72%	
	Sub Total	**5.20**	**2.60**	**0.88**	**33.83%**	**16.92%**	
	Total, Recurring expenses	**138.68**	**69.34**	**48.70**	**70.23%**	**35.11%**	
	E. Non-recurring expenses						
1	Library Books	0.30	0.15	0.00	0.00%	0.00%	
2	Smart Class	0.80	0.40	0.00	0.00%	0.00%	
3	Sport Equipment	0.20	0.10	0.00	0.00%	0.00%	
3	Kitchen Expenses	0.10	0.05	0.00	0.00%	0.00%	
4	Furniture & Fixture	0.30	0.15	0.00	0.00%	0.00%	
6	Cultural Dresses	0.20	0.10	0.00	0.00%	0.00%	
7	New CC TV Camera & Maintenance of old Camera	0.75	0.38	0.13	34.04%	17.02%	
8	New one Two wheeler	0.75	0.38	0.00	0.00%	0.00%	
	Total, Non-recurring expenses	**3.40**	**1.70**	**0.13**	**7.51%**	**3.75%**	
	Grand Total	**142.08**	**71.04**	**48.82**	**68.73%**	**34.36%**	